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THE IMPERIAL COLLEGE OF TROPICAL AGRICULTURE, TRINIDAD, B.W.I.

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TROPICAL AGRICULTURE is published at the Imperial College of Tropical Agriculture, St. Augustine, Trinidad, West Indies, at the end of the third week of the month preceding the one of issue. Advertisement rates can be obtained at the College from the Editor, or from the Secretary of the College, 14, Trinity Square, London, E. C. 3, England. The Editor will be glad to consider authoritative articles for publication. It is understood that opinions expressed in signed articles are those of the author and do not necessarily represent the policy or opinion of the College Authorities. Increasing numbers of inquiries are being received from various parts of the tropics which can be answered only by persons possessed of an intimate knowledge of local conditions. Enquirers should first satisfy themselves that their local Department of Agriculture is not able to supply them with the desired information before communicating with us. Correspondence which will be replied to is invited on all other matters pertaining to tropical agriculture, science and development.

THE NEEDS OF THE COLLEGE.

II.

IN our editorial for the March issue of *Tropical Agriculture* we advanced reasons for the widening of the field of financial support to the College. The direct appeal is no doubt to the Colonies and dependencies, but it is also in varying degrees to those commercial bodies whose interests are bound up with the production, distribution and use of tropical produce. Further production is a source of wealth to a country and tropical development stimulates a demand for manufactures which the mother country can supply and an appeal, therefore, lies to all manufacturers of such goods. Lastly, through its food supply, which is in many articles tropical in origin and through its clothing particularly in cotton, the general population is not uninterested in a movement aimed at hastening the opening up of the tropics. The main and most direct appeal, however, is to those Colonies and dependencies which lie within the tropics and those Corporations and Syndicates which are directly engaged in development and require the services of a trained staff. It is only natural that anyone to whom an appeal is directed, should claim the right to information as to the objects to which funds given in response to that appeal will be devoted and it is a claim that should be met fully and freely. We propose, therefore, to meet that claim here and in advance.

The College is situated 7 miles from Port-of-Spain in the growing suburb of St. Augustine. There are 35 students in residence a few only of whom have homes within daily reach of the College. With the adoption of the Lovat scheme for the training of agricultural officers for the Colonial service the number will be largely increased and it appears probable that for the next session there will be somewhere near 50 students. This is too large a number for the strictly limited resources of the neighbourhood and the question of a hostel, hitherto lacking owing to want of funds, has become urgent. On other grounds too, it is desirable; on more than one occasion our best friends in the West Indies have expressed doubts as to the wisdom of their sending their youth to an institution where the control afforded by a hostel cannot be exercised. A hostel, therefore, takes a primary place in our list of requirements.

The importance of an estate, of a size which admits of economic management can be effectively demonstrated, has been repeatedly emphasized.

Agriculture is not merely the production of healthy crops, but the production of these under economic conditions. Practical experience of cultivation under such limitations is an essential one for the full equipment of the student who is to make his career in the practice of agriculture in the tropics; it is equally essential that the agricultural advisers of Colonial Governments shall bring a sound knowledge to bear on the economic problems with which they will be confronted.

A feature of the College, which shares its importance with teaching, is research. Research is not only the function of the staff, but forms a part of any true post-graduate course. But research requires a knowledge of what has been, and is being done at other institutions; a knowledge derived from a study of literature. In an institution separated by miles of sea, journeys to consult libraries or for the borrowing of books are impossible. A fully equipped library, therefore, is a *sine qua non* of research as well as of post-graduate study and the provision of books and journals is, under the circumstances, a heavy item which is as yet far from being fully met. A number of the essential journals are lacking while sets of journals are in only a few cases available.

The large addition to the library here forshadowed means additional space, and with the additional students which are expected considerable enlargement of the reading room accommodation will be required. If, too, we consider the laboratories, these have been designed for classes of 12, a number which with our rapid expansion, will be almost immediately exceeded. We are already, therefore, considering the best means of expansion to meet these requirements.

The above requirements are of a capital nature. Expansion, such as indicated above, means, however, extra recurrent expenditure. Even for the present requirements our income is quite inadequate. We have at the present time 4 sections of the College staffed by a single officer; they are Agriculture, Economics, Mycology and Sugar Technology, while the Professor of Economics, performs the duties of Librarian and Editor of this Journal. In these instances there is absolutely no reserve for leave or illness, both matters of added importance in a tropical country where leave means a visit to England, and substitutes in the case of illness are not available. An expansion of staff to meet these requirements is an urgent necessity.

The splendid gift of the British Sugar Manufacturers of a balanced and up-to-date factory has to be idle this year through lack of funds. This factory, though capable of turning out 2 tons of sugar a day, is not, and cannot be, if it is to fulfill its function adequately, an economic proposition. To obtain the maximum educational value, it is fitted with machinery of greater complexity than a factory of similar output and working on a business basis. In future years research will involve a certain period of each season when running will not be economic and the loss which is bound to occur on both heads has to be met out of income.

Finally, laboratory and field grants are now cut down to a minimum. With the large number of post-graduate students now in sight, most of whom will be taking up investigational work in the laboratory and fields, extended laboratory equipment and larger areas than are now available for the cultivation of plants under critical study, are essential.

During the last few days we have received information that the British Government have given a capital grant to the College of £15,000, to which is coupled the condition that a hostel be erected, with an additional grant of £3,000 for general purposes in 1926-27. This is a valuable addition to the funds of the College which will largely remove the first of the disabilities referred to above. In other directions, however, it only adds to our embarrassments. It enables us to accommodate the larger number of students that the future only too clearly holds in store, but it does not provide those other facilities which are essential to adequate instruction. The main value of this grant, therefore, is not financial, its greatest asset is that it confers on us the aegis of the British Government. Given at this stage when the College is in its fourth year and when its students are already to be found in such widely scattered lands as Ceylon, Nyasaland, Uganda, the Sudan, and Nigeria, as well as in the West Indies, it means that in this short period the College has justified its existence and has established its claim to wide recognition. We strongly hope that the example of the West Indies, backed as it now is by the example of the British Government, will be followed by Colonial Governments and by all interested in tropical development. Our needs are dual, not only do we require capital, but an assured income. The former is required to meet both our urgent needs and, as stated in Lord Milner's original appeal, to build up an endowment fund. Until capital in sufficient quantity to build up an endowment fund is forthcoming we have to look to contributions from Governments, from development companies and from such like personal and impersonal agencies for the annual income required to enable the College to continue as it has commenced.

The Makwar Dam on the Blue Nile near Sennar, which was opened on 21st January, is stated to be the largest in the world, and has cost between £9,000,000 and £10,000,000. It is built of granite and has been financed by the Sudan Government under a British guarantee.

The dam, the greater portion of the work upon which was carried out by Messrs. S. Pearson and Co., Limited, in twenty-three working months was built to hold up flood water which had previously run to waste. This forms a lake 50 miles along the river to irrigate 300,000 acres of the plain between the rivers above Khartoum for the growing of cotton and other Sudan produce. —*Exchange.*

INDIAN SCIENCE CONGRESS.

The Indian Science Congress which held its 13th annual meeting at Bombay in January last was presided over by Mr. Albert Howard, Director of the Institute of Plant Industry at Indore and Agricultural Adviser to the states in Central India. In the course of his address as President of the Congress, Mr. Howard reviewed the beneficial results which have followed the practical application of botanical science to agriculture during the past quarter of a century. In India the improved types of wheat produced by the Pusa Research Institute already cover more than two million acres. In discussing the relation of irrigation to agriculture Mr. Howard mentioned the immediately beneficial results which follow the development of an irrigation system and continue for some time provided water is ample in volume and well distributed. For the canals to pay their way and bring in the greatest revenue the water must be distributed so that the most expensive crops such as cotton and sugar-cane can be grown with fairly frequent applications and no check in the rate of growth during the life of the crop. It is found, however, that with continued irrigation there is a tendency after a few years for the soil condition to deteriorate and patches of alkali or dead soil appear. Such dead soil areas produce no crops and often increase and result in considerable areas formerly fertile districts becoming worthless for crop production.

Mr. Howard also refers to the relation which seems to exist between the effects of canal irrigation and an abundance of malignant types of malaria. It is suggested that this relationship between malaria and a deteriorated soil is not so much due to the breeding of the mosquitoes and the infection of the people by the malarial parasite as it is to the effect of an inferior quality of food grown, produced under conditions resulting from soil deterioration; the supply of poor food-stuff results in under-nutrition for the people rendering them more susceptible to the ravages of the malarial disease.

In the discussion of the effect of irrigation on soil fertility reference is made to the difference between rain water which falls upon the land, carrying a large amount of oxygen with it, and canal water which is very much poorer in its supply of oxygen. The difference required in the time occupied in the application of the given bulk of water by rainfall and by canal supply is also mentioned as one of the contributing causes in the decrease of soil fertility under canal irrigation, where the same crops are grown year after year on the same land.

Very little progress in the prevention and cure of alkali soils has been made up to the present in India; attempts to reclaim these soils have not been successful and very little is known of the causes which produce the alkali phase in these different soils. It is believed that the origin of alkali lies in the defective soil aeration which slowly establishes an anerobic soil flora.

In discussing the work done in recent years in connection with the pests and diseases of crops Mr. Howard states that in spite of the immense amount of work that has been done and the vast amount of literature accumulated, agricultural practice has been remarkably little advanced. In the case of sugar-cane at least it has been found that the most practical method of dealing with its fungus diseases is the production of new and resistant varieties; improved cultivation also plays an important part, for healthy plants possess a high degree of immunity to insects and fungi.

In closing his address Mr. Howard makes a plea for concerted action or team work in the attempt to deal with agricultural problems of all sorts together with the development of trained men who can view agricultural operations from a wide angle and who will, while being specially trained, still have the broad outlook which will enable them to apply the principles of several sciences to the solution of particular problems. The solution of the problems depends on the broad training of the right type of man who is the ideal combination of knowledge and aptitude. Many problems have been defined and are awaiting solution. What is now needed is a combination of the trained investigator, the problem and the means for carrying out the work.—*The Pioneer Mail.*

BARBADOS.

We understand that the Bill introduced by the Select Committee for establishing a Department of Science and Agriculture in Barbados, has been passed by the House of Assembly. An Advisory Board of Agriculture has been formed, consisting of one member of the Legislative Council, two members of the House of Assembly, the President of the Agricultural Society and the Director of Agriculture. The Staff is to be appointed by the Governor and will consist of a Director of Agriculture, and Assistant Director and Botanist, an Entomologist, an Assistant Agricultural Chemist, an Assistant to the Professor of Chemistry and a Lecturer in Natural and Agricultural Sciences, together with a number of clerks, messengers, field and laboratory assistants.

The new Department appears to unite under one Administrative head the activities of the Department of Agriculture, the Island Professor of Chemistry and the Department of Agricultural Science at Harrison's College.

Subscriptions to Lord Milner's Appeal for £100,000 as an endowment fund for the Imperial College of Tropical Agriculture should be addressed to the Secretary, Imperial College of Tropical Agriculture or to the bankers of the Fund, the Colonial Bank, 29, Gracechurch Street, E.C.

ECUADOR CACAO.

(*Concluded.*)

In 1917 great alarm was felt by growers who had large plantations of Venezuela cacao on account of the rapid falling off in production, caused by the rotting of the almost mature pods. The writer, who at the time was Mycologist to the Board of Agriculture of Trinidad, was called to Ecuador by cable to make a report on this trouble. From 16th November, 1917, to 24th January, 1918, was spent in this work.

It was found that the loss was caused by a plant disease of fungous origin, the agent being a species of the genus *Monilia*. The disease was able to spread very rapidly during the rainy season and during the whole year in plantations near the foot-hills of the Sierra, where there is rainfall nearly every day. In many cases more than 99 per cent. of the pods were destroyed In the report referred to it was suggested that the only hope of controlling the disease would be by the use of fungicides, but it was also pointed out that the system of planting and caring for cacao in Ecuador was very primitive and that under existing conditions the application of fungicides would be very difficult and expensive.

During 1918, which was a very wet year, the disease spread rapidly, and even attacked the Nacional to some extent. The writer again returned to Ecuador for the purpose of carrying out spraying and dusting experiments to learn if it would be possible to control the disease in this way. In the two succeeding years a number of experiments were made on haciendas in different places, using Bordeaux mixture of different strengths, self-boiled and commercial lime sulphur solutions, as well as copper sulphate and lime dusts and flour of sulphur. For this work power sprayers with both vermorel nozzles and spray guns and a power duster were used. These experiments showed that many applications at frequent intervals were necessary to control the disease at all successfully, and that the cost of the work was absolutely prohibitive, being far in excess of any benefits derived therefrom. In this connection it must be remembered that the average yield of the cacao tree is very low, while the bearing season extends throughout the year, so that the infection period is not limited to a few days or even weeks as it is in temperate climates.

The following table of the annual yield of a plantation consisting of 35,000 Venezuela trees situated in the more rainy zone will give an idea of the rapidity with which this disease has spread under favourable atmospheric conditions:

	Quintals.	
1916 ..	650	Monilia not present.
1917 ..	710	Monilia not present.
1918 ..	226	Monilia appeared.
1919 ..	36	Monilia continued.
1920 ..	The plantation was abandoned this year, the trees cut down, and bananas planted in their place.	

The result of this rapid spread of *Monilia* has been that plantations containing several millions of Venezuela trees have been completely abandoned since 1919, while others in districts where the rainfall is light yield enough to pay for their upkeep and in some years give profits.

The *Monilia* has never done great damage in the old fields of Nacional cacao, especially in the drier Arriba district. This variety of cacao apparently has a great amount of natural resistance to the fungus, which as yet remains peculiar to Ecuador.

The effect of the disease on the export of cacao from Guayaquil is well shown in the following table showing exports, 1913 to 1925, in quintals of 101.4 pounds:

	Quintals.		*Quintals.*
1913 ..	859,085	1920 ..	754,479
1914 ..	922,119	1921 ..	827,358
1915* ..	713,785	1922 ..	832,788
1916 ..	980,549	1923 ..	606,519
1917 ..	900,953	1924 ..	623,456
1918 ..	760,287	1925† ..	510,956
1919 ..	750,482		

The sudden drop in exports in 1918 and the succeeding years until 1923, as compared with 1916 and 1917, was due to the ravages of the *Monilia* disease in the plantations of Venezuela cacao, many of which were completely abandoned.

The still further annual drop of over 200,000 quintals from 1922 to the date of this report (19th August, 1925), has been due almost entirely to the outbreak of a second parasitic disease in the plantations, known as the witch-broom, which is far more serious than *Monilia* and bids fair almost to exterminate the cacao industry of Ecuador.

In June, 1922, specimens of abnormal branches of cacao were brought to the writer from a hacienda in the Balao district. These growths were at once recognised as the witch-broom or *Krulloten* characteristic of the disease of the same name which up to that time was known only from Surinam and the adjacent parts of British Guiana. Realising the serious nature of this outbreak a visit was at once made to various haciendas, and it was found that the disease was present to a greater or lesser extent throughout the whole of the Balao region. The fruiting bodies of the causative fungus *Marasmius perniciosus*, so ably described by Dr. Gerold Stahel of the Department of Agriculture of Dutch Guiana, were found in abundance on the witch-brooms. This left no doubt that the disease in Ecuador was the same as in Surinam, and is justly the most feared of all cacao diseases.

A circular describing the disease was immediately sent to all cacao growers, and at the same time experiments were begun in order to see if the disease might be controlled in any way. Though large sums were spent in spraying, dusting, collecting, and destroying the witch-brooms, and even in cutting down whole orchards where the

* Year of drought. † To 1st August.

infection was worst, all was of no avail, and it was soon realised that the whole of the Balao district as a cacao producer was doomed.

The rapidity with which the disease spread is well shown in the accompanying table, which gives the total production of all the leading haciendas of Balao district from 1918 to the end of June, 1925.

Showing how production has declined because of Witch-broom Disease.

The total number of trees from which production was obtained is 7,485,980.

Production is in quintals of 101.4 pounds each.

	Quintals.		*Quintals.*
1918 ..	67,411	1922 ..	77,817
1919 ..	56,341	1923 ..	37,668
1920 ..	73,722	1924 ..	18,480
1921 ..	85,455	1925 ..	1,987

The cacao fields of practically all of these haciendas have not been cleaned in over a year, and they are rapidly turning to tropical jungle. A few have been replanted to banana and coconut palms.

In 1923 isolated witch-brooms were found in various places in the Arriba district and though there the atmospheric conditions are not so favourable for the rapid spread of the fungus as in Balao, nevertheless since that time there has been gradual increase in the disease until now it is present to a greater or lesser extent in practically every hacienda in Ecuador. Already in some of the up-river plantations 20 per cent. or even 30 per cent. of the trees are affected, and it is very probable that a number of these will be abandoned within the next two or three years, or at least the cacao replaced with coffee or some other crop.

Recently the writer has visited a number of haciendas in the Arriba district and also has read a report made by the inspector of a large group of haciendas in that region. There can be no doubt that the situation is very serious not only for the cacao growers but for the whole country as well. At one time it was hoped that there would be a large "Christmas" crop this year, but it is certain now that this will be far below expectations, and it is doubtful if the exports for the year will reach 700,000 quintals. (On 6th October, Guayaquil reported that the maximum receipts for the year would probably be 625,000 quintals.)

Judging the future from the past, and basing calculations upon the data from Surinam, the disease will continue to spread and will do more damage each year. The annual production of cacao may be expected to decrease until the critical year when atmospheric conditions will be very favourable for the rapid spread of the fungus. In that year the exports from Guayaquil will probably fall to 200,000 or 250,000 quintals, after which they may increase to a certain extent, but will never again reach 500,000 quintals.

The table given herewith is curtailed to show total production only.

Crops of Cacao Beans in Ecuador.

Quantities in Spanish quintals of 101.4 *pounds.*

	Total.		
1909 ..	690,620	1918 ..	819,099
1910 ..	798,551	1919 ..	826,580
1911 ..	853,678	1920 ..	865,010
1912 ..	782,332	1921 ..	884,898
1913 ..	932,852	1922 ..	877,404
1914 ..	971,678	1923 ..	606,517
1915 ..	769,752	1924 ..	624,452
1916 ..	1,179,252	1925* ..	540,958
1917 ..	1,008,767		

* January to July inclusive.

CORRESPONDENCE.

We have recently received a letter from a gentleman well known in London cocoa circles who asks why, after the successful effort of the World's Cocoa Conference in 1924, apparently nothing has been done to carry on the work. He points out that the India Tea Association during the last five or six years has spent no less than £500,000 on propaganda and suggests that if one centre is able to do this "surely the whole cocoa world, producers and manufacturers, need think nothing of £250,000 spread over five years." He argues that the United Kingdom is consuming more cocoa this year than last, but asserts that "a strict censorship is put on all sales," with the result that prices are depressed. He infers that with proper organisation, London would soon regain its good reputation among producers, as a cocoa market, and wonders why producers are making no effort to remedy the situation. Our correspondent recently had an interview with the Brazilian ambassador in London and appears impressed with the determination of Brazil to put her cocoa house in order and her willingness to co-operate with other producing countries towards the same end.

NICARAGUA'S COFFEE CROP.

A Report from Corinto says that no difficulty is anticipated in financing the coffee crop, which is estimated at 325,000 to 350,000 quintals, after deducting the 40,000 to 50,000 quintals said to have been destroyed by the Santiago volcano. No coffee has been held over from the preceding crop.

Eruptions of the Santiago volcano in Nicaragua have roasted coffee on the trees, and the damage to plantations has diminished what otherwise was expected to be a record crop. The crop is estimated locally at 32,988,000 to 35,490,000 pounds, according to a report received by the Commerce Department on 15th January. The 1924-25 crop was 20,280,000 pounds, due to drought and the heavy 1923-24 crop 40,560,000 pounds was the largest on record. The present crop would have been equally large save for the blighting of many trees by the volcanic sulphur fumes.—*The Tea and Coffee Trade Journal.*

COFFEE AND COTTON IN BRAZIL.

THE author of a little book designed to instruct coffee merchants in the fundamentals of the coffee trade has this to say regarding the extent of the knowledge which an operator in coffee should possess:

"The coffee trade's centre of gravity lies in Brazil, whence comes 75 per cent. of the world's production. To follow the coffee market and to judge whether it is opportune to buy at any given time, there is required not only an accurate estimate of the purchasing power of importing countries, fluctuations of exchange, freights, insurance, &c., but also an intimate knowledge of Brazilian conditions, Brazil's general economic situation, the national and state finances, the fluctuations of internal politics, and many other factors of imponderable nature which may exert the strongest influence on that country's trade and finance."

This is a large order; if to qualify as a perfect coffee merchant every proprietor of a roasting establishment had to undergo an examination along these lines, it is anybody's guess as to how many would attain a rating of 100. On the whole, however, the trade manages to get on fairly well with the aid of such information as filters through the language barrier. But when it is a question of prognosticating the general course of the market over more extended periods, it may be necessary to go rather far afield in search of contingencies which may be capable of modifying basic conditions and of exerting a more or less profound influence on coffee supplies and prices. Take, for example, this highly interesting question, "Are coffee prices likely to come down in the near or distant future? If so, what would probably be the range of their fall, and what are the circumstances that will limit their decline?"

The coffee trade is fairly well informed regarding the influence now dominating the Brazilian coffee market. In so far as the Institute for the Defence of Coffee and the Stephanoderes pest are concerned, we have to reckon with factors that will continually work for high prices of Brazilian coffee. But suppose the institute proves inadequate to perform the task assigned to it, and suppose the Stephanoderes disappears miraculously from coffee groves now infested, what could then intervene to give firmness to prices?

In articles recently published in this magazine it has been shown that there is a decidedly wide margin between the price of coffee and the cost of producing it in the Dutch East Indies where there are a good supply of capital and an abundance of labour as well as wide areas suitable for growing coffee. In spite of these apparently ideal conditions, until quite lately, coffee culture in those regions has shown little or no tendency to expand. The reason for this apparent reluctance of such an enterprising people as the Dutch to engage more extensively in a line that on the face of things appears to offer excellent profit is because they could find even better employment for their capital. In a word, the world has been bidding higher for the use of labour and capital in the production of rubber, tea and oils than in the production of Java or Sumatra coffee.

Coming back to Brazil we ask the question, "Is there any actual competition in that country for the use of land, labour, and capital now employed there in the production of coffee? What avenues of escape are open to Brazilian labour and capital if the price of Brazilian coffee should fall too near the economic limit? What could attract the forces of production away from coffee even while the margin of profit is still comfortable? At about what price level would new labour and capital hesitate about flowing into Brazilian coffee production."

The coffee regions of Brazil are exceedingly rich in their agricultural possibilities; many staple crops grow exceedingly well in the State of Sao Paulo; but the discussion will be limited to consideration of the position that the cotton industry now occupies in that country, and to what extent it is likely to act as a brake on any future decline of coffee prices.

The cotton and coffee markets at present are affected by basic conditions that present many points of resemblance. The main source of the world supply in each case lies in a single producing region, Brazil for coffee and the United States for cotton. Due to conditions existing in the United States the supply of cotton is much below demand, cotton goods are high in price and there is a clamorous need for more cotton in the great centres for spinning and weaving. The United States appear incapable of increasing its production, and manufacturing interests are doing what they can to stimulate production in other countries. Due to conditions in Brazil, available coffee stocks are insufficient to meet the needs of the distributors and the price of coffee is consequently high; hence there has arisen among consumers a desire to see increased production in other coffee producing regions.

Brazil produces both cotton and coffee, so that the agriculturist in Sao Paulo, where cotton thrives and most of Brazil's coffee is produced, has before him the choice of growing either or both. It is hardly necessary to emphasize the conclusion that, while the returns from coffee are high in comparison with the returns from an equivalent amount of labour and cost expended on cotton, there will be no pronounced drift from coffee to cotton. On the other hand, if the balance runs the other way, cotton will tend to take the place of coffee.

In 1920 the value of the Brazil cotton crop was about two-thirds the value of the coffee crop; at the present time the country produces the equivalent of 750,000 bales annually, and, although this is only 3 per cent. of the world crop, it is enough to give Brazil fifth place among cotton-growing countries; potentially it could easily take the place now occupied by the southern United States.

The Brazilian government has addressed itself to the cotton problem with considerable energy, several cotton-growing experiment stations have been established; improved seed is being distributed on a large scale; and very favourable conditions are provided for the establishment of new cotton plantations and the erection of gins. The cotton production is being concentrated in Sao Paulo, which now produces about a quarter of the total crop. There are now 55 modern cotton mills in Sao Paulo; within little more than 10 years Brazil's cotton imports have decreased almost to the vanishing point; her more than 30,000,000 population is practically independent of foreign mills for all except the finer weaves and exportation is growing.

Now, what repercussion is this expansion likely to have on the coffee industry? It may be said at once that there is no probability that cotton or any other crop will ever drive coffee out of Brazil. What it can do, and along with other crops is doing, is to deprive the coffee fazendeiros of part of their cheap labour and to make the growing of coffee more expensive.

(*To be continued.*)

MYCOLOGICAL NOTES.

Bunchy Top Disease of Bananas.

The West Indian region is not the only area in which attempts to cultivate bananas on a plantation scale have been checked or brought to nought by a transmissible disease. According to a report by a committee of three scientists appointed by the Governments of New South Wales and Queensland to examine the situation brought about by the Bunchy Top Disease in the coastal areas near the borders of those States, a promising industry was almost ruined in the eight years between 1916 and 1924. The disease, the cause of which was, and seems still to be in doubt, was introduced about 1914 to the Tweed River district of New South Wales in suckers from Fiji where it had been known for over thirty years and was taken accross the border, into Queensland a couple of years later.

The disease is characterised in general by the reduction in the size of the leaves, which, owing to the shortened sheaths, are bunched and stand erect at the top of the pseudo-stem; they are light green or yellowish green in colour and as they mature become markedly corrugated due to unequal growth of the tissues. An early sign of attack is the presence of dark green streaks and spots up to two inches in length on the mid-ribs and adjoining stalks of young leaves while irregular dark green lines appear on the blades between the main veins and overlying the secondary veins. The texture of the leaves is brittle so that they are easily crushed. The main fleshy roots look dull and show purple patches and the laterals die prematurely. Internal signs are not constant enough to be regarded as characteristic. A preliminary microscopic examination of affected leaves indicated a structure (details were not mentioned) profoundly different from the normal. The signs of disease may be present in suckers from the beginning of growth, or may appear in a later stage of development, sometimes not until after shooting and then may be restricted to a greening of the tips of the purple bracts; the fruit, if any develops, is stunted and brittle. Suckers affected from the start of growth may die but stools can continue to produce diseased shoots for several seasons or may even give rise to shoots which show no signs of disease at first, although liable to develop them later. The disease is not dependent on soil or weather, but spreads steadily once it is introduced into a plantation. Bunchy Top was investigated by a scientist in Fiji in the early 90's of last century; he attributed it to root infestation by nematode but eelworms are frequently not present in the roots of typical cases and no other parasitic organism has been found regularly present in affected plants and none has produced the disease following inoculation. The signs and behaviour of Bunchy Top are quite suggestive of a disease of the mosaic type due to an infective virus. This possibility has not escaped notice and as an aphis is common on bananas in the infected territory, it was suspected to be the transmitting agent. This had not been proved (1924) and attempts to control the aphis on the plants by frequent spraying with kerosene emulsion in some cases delayed, but did not prevent the appearance of disease signs: such treatment could furnish no definite evidence for or against aphis transmission. On the recommendation of the Committee the biologist to the Department of Agriculture in New South Wales, Dr. G. P. Darnell Smith was furnished with suitable equipment for a thorough investigation of Bunchy Top the results of which have not, to the writer's knowledge, been published yet. They also advised that a horticulturist be sent to Fiji to examine the situation in those islands as it was understood that the disease was giving little trouble there in 1924. It may be added, that Bunchy Top has been introduced into Ceylon within recent years and has affected many varieties of bananas and plantains there being regarded now as a serious menace to the cultivation of an important native food crop. The variety grown mainly in Australia and Fiji is the dwarf (Chinese, Cavendish or Governor) and it is, therefore, the kind that has been so heavily attacked by Bunchy Top in those territories.

S.F.A.

REFERENCE.

Investigation of Bunchy Top Disease of Bananas (Report of Committee—Messrs. R. D. Watt, E. J. Goddard and J. G. B. Osborn).—*Queensland Agricultural Journal*, Vol. 21, Part 4, 1924.

The Editor will be pleased to send a gratuitous specimen copy of *Tropical Agriculture*, post free, to anyone interested in tropical development.

UNDESIRABLE PASTURE PLANTS.

A useful pamphlet dealing with pastures and their improvement has recently been issued by the Superintendentof Agriculture for the Leeward Islands, Hon. A. E. Collens, F.I.C., F.C.S. Among the various topics discussed with special reference to Antigua conditions is the question of undesirable herbage and trees. The following extracts in this connection may be of interest to agriculturists generally. Unfortunately, many of the plants are known by different names in different localities; nevertheless, calling attention to the large number of such plants that exist should impress stockowners with the need for greater vigilance in this respect, as indeed in the whole aspect of pasture improvement, so often neglected in the tropics:—

Undesirable types of plants come under three headings:—

(*a*) Undesirable on account of possessing burrs or spiny seeds, &c.

(*b*) Undesirable on account of poisonous or deleterious properties.

(*c*) Undesirable on account of imparting, when eaten, an unpleasant odour or taste to the milk of the animal.

A. Types possessing spiny burrs and seeds.

The common burr grass (*Cenchrus tribuloides*) is the chief offender in Antigua; it is common everywhere and especially on sandy spots and near the sea shore. In its young state the grass is edible, but when fruiting it is most objectionable as the burrs lacerate the animals' mouths and may cause festering wounds.

Martynia diandra or Devil Burr, one of the Gesneriaceae, is occasionally met wild in the West Indies, but so far I have not observed it in Antigua. It has a showy bell-shaped flower, the fairly large seeds, measuring nearly an inch in length, however, possess two sharp curved hooks.

B. Types with poisonous or deleterious properties.

Common or fairly common types are:—David's bush, Trumpet flowers and Wild Fire Bush (*Datura suaveolens*, *Datura Metel* and *Datura Tatula*). These all contain mydriatic alkaloids principally atropine, hyoscyamine, and scopolamine all of a highly poisonous nature. Wild ipecacuanha or Johanna (*Asclepias curassavica*) and wild tobacco (*Calotropis procera*). These contain a yellow bitter resin, producing vomiting and severe tetanic spasms and are poisonous irritants. They should be carefully eradicated from pastures.

Worm seed or Brinvilliere (*Spigelia anthelmia*) possesses purgative and narcotic properties and is an anthelmintic. It is not very common in Antigua.

Star of Bethlehem (*Isotoma longiflora*) is considered all throughout the West Indies as poisonous to stock. Recent investigations conducted in Porto Rico throw some doubt on this point. It occurs in several districts in Antigua. According to the Treasury of Botany it is a most venomous plant producing dangerous cathartic symptoms. It proves fatal to horses that eat it.

Galloping Warner or Male Ipecac (*Euphorbia heterophylla*). Like most of the euphorbias this is a powerful irritant and highly corrosive Fairly common especially along roadsides

Mexican thistle or yellow hollyhock (*Argemone mexicana*). This is a common field weed in Antigua; it belongs to the poppy family. Its general properties are of a narcotic and stupefying nature and for this reason it may be considered undesirable.

White Head or (*Parthenium hysterophorus*). A very common weed especially in stony and calcareous places. It is a powerful depressant, affecting the heart.

Bastard mustard (*Cleome triphylla*) possesses vesicant properties which, however, are lost on boiling. The East Indians utilize this plant as a type of spinach.

Old Woman Bush or Blister Leaf (*Plumbago scandens*) contains plumbagin and is a vesicant irritant, and narcotic.

Cow Itch (*Mucuna pruriens*). The hairs from the dried pod are intensely irritating.

Physic Nut (*Jatropha Curcas*) and bastard physic nut (*Jatropha gossypifolia*). The seeds of these contain an oil of a highly purgative nature accompanied by symptoms of burning heat and disagreeable sensations. An additional type of Jatropha, *J. urens*, has reddish brown leaves which sting most violently and even blister.

Castor seed (*Ricinus communis*). The foliage of this plant is valued as a fodder in India, it being also claimed that it increases the flow of milk; but it must be borne in mind that the seeds are poisonous, due to the presence of a toxalbumose, "Ricin."

Noyau vine (*Ipomea dissecta*). This is very common along fences and is frequently met overgrowing shrubs. The leaves and stems contain a cyanogenetic glucoside (Linamarin or Phaseolunatin), on bruising or crushing the leaves they give off an odour of benzaldehyde or bitter almonds and free hydrocyanic (prussic) acid is liberated.

Dumb cane (*Dieffenbachia Seguine*) occurs in damp or moist places. The juice of the plant is excessively acrid and blistering. It is named "Dumb Cane" in consequence of its fleshy stems rendering speechless any person who may happen to bite them.

Deadly Night Shade (*Atropa arborescens and Atropa sp.*) A narcotic and stupefacient containing the alkaloid atropine and is a powerful poison.

Maiden's Blush (*Momordica Charantia*) and Bottle Gourd (*Lagenaria vulgaris*) are both cucurbitous plants with a purging or cathartic action and very drastic in effect.

In connection with the types mentioned above it is possible that the grazing animal avoids these plants by instinct, but the chief danger lies in their being included in cut fodder and thus being fed to the animals in stables or byres.

C. Types responsible for a bitter, acrid or repellant taste in the milk produced.

Chief among these may be cited the weed locally termed as Cudjo root and known as Gully root (Barbados) or Mapourite (in the Spanish speaking islands), *Petiveria alliacea*. This is a well known West Indian weed which appears to luxuriate under conditions of shade. It is a very common local weed possessing a characteristic garlic odour, hence its scientific name, one of its constituents being trimethylamine, of a fishy and repellant odour.

Fit weed (*Eryngium foetidum*). This is a small umbelliferous plant possessing a nauseating and sickening odour which is very persistent, if one has handled the plant; it possesses very powerful emmenagogic properties.

Stinking weed (*Cassia occidentalis*). This yellow flowering Cassia has a strong and somewhat foetid odour and its consumption by animals would be likely to taint the milk. Apart from this it has no poisonous properties and the seeds are sometimes roasted and used as a substitute for coffee.

Nunu Balsam—Mosquito Bush or Basil (*Ocimum micranthum*). This plant possesses a powerful peppermint-like odour and may, if eaten, affect the odour of milk. It is a general stimulant and is much used locally in infusions.

Wild Sage Cariaquite (*Lantana Camara*). Like the above, this plant is also a general stimulant. The leaves are bitter and possesses a strong smell of sage.

Worm Bush (*Chenopodium ambrosioides*). This plant is much employed in the West Indies as a vermifuge and anthelmintic. It is very common in Antigua, especially in stony places. It possesses to a high degree the characteristic odour of oil of chenopodium.

Wormwood or Absinthe, Green bitters (*Artemisia* sp.). A small plant with a powerful and penetrating odour, and with an aromatic bitter taste. It is used in the West Indies to make green bitters.

Among undesirable trees for shade or other purposes in Antigua the following may be cited:—

Hippomane mancinella or the ordinary manchineel. Every part of this plant is toxic and it may be considered as a most undesirable tree in any pasture. Cattle shading under its foliage during rainfall are liable to suffer from blistering and there is the possibility of its so-called apples being mixed up with the fodder. These are intensely blistering and toxic and many cases of poisoning both of human and animals have been traced to them.

Crescentia cujete, the common Calabash tree of the West Indies may on general lines be considered an undesirable tree in pastures, the flowers and young fruit being generally considered in the West Indies as an abortifacient and also possessing powerful purgative properties.

Wild tamarind (*Leucaena glauca*). This tree possesses an extraordinary deeply rooted tap root, and is accordingly very difficult to uproot. It is objectionable on this account and especially so owing to the fact that horses feeding on the leaves completely lose the hair from their manes and tails, this also applies to mules and donkeys. It is also reported as causing pigs to lose their body hair completely. Ruminants do not appear to be affected.

Nerium Oleander. A very common West Indian shrub and highly poisonous. The foliage contains several poisonous glucosides acting as cardiac poisons and with a strychnine like action on the spinal cord and there are several cases on record of the poisoning of stock due to the consumption of the leaves admixed with mown grass. The amount necessary to cause death in horses ranges from one half to three-quarter ounce of green leaves but more of dry leaves. In cows, even a less amount is sufficient to cause death.

Lucky seed. *Thevetia neriifolia*. This tree also contains poisonous principles, due chiefly to the glucoside thevetin, causing gastro-intestinal irritation followed by cardiac poisoning. The symptoms are easily mistaken for arsenic poisoning.

Dog wood (*Piscidia erythrina*). This is a fairly common species in Antigua, growing wild, especially in the drier and more saline districts. It is a powerful fish poison and is used as such and is an intense narcotic, possessing stupefacient properties. A tincture of the bark is often used in the United States instead of opium.

Turpentine Tree. *Bursera gummifera*. A very common tree in Antigua and especially utilised for fence posts owing to its quick growing habits from cuttings or posts. The bark of this tree has well-known and powerful purgative properties which probably extend to the foliage.

Horse radish tree or Oil of Ben tree. *Moringa pterigosperma*. This plant is very common in Antigua, being generally known under the title Eringo. Its foliage is generally considered as possessing irritant and blistering properties. The young pods can, however, be cooked as a substitute for French beans, while the scraped root is stated to be a fairly good substitute for horse radish.

THE IMPERIAL INSTITUTE, LONDON.

In accordance with the provisions of the Imperial Institute Act, 1925, which became operative on 1st July, the control of the administration and management of the Institute was transferred from the Secretary of State for the Colonies to the Parliamentary Secretary, Department of Overseas Trade. The amalgamation of the Imperial Mineral Resources Bureau with the Imperial Institute was also effected on 1st July, 1925.

THE CHEMISTRY OF SULPHITATION.

Sulphitation in the Cane Sugar Factory.

Mr. R. G. W. Farnell, Chemist to the British Empire Sugar Research Association, who performed many of his earlier experiments at the Imperial College of Tropical Agriculture, has now given us some results of his later investigations, carried out at the Imperial College, South Kensington, London. These results are published in the *Journal of the Society of Chemical Industry*, Nov., 1925, 44, Nos. 48 and 49, pp. 530 T. and 533 T., from which the following summary is taken.

Collected data from published literature are first submitted in order to describe (1) the solubility of calcium sulphite in water and in sugar solutions, (2) the reaction of solutions obtained by adding different amounts of calcium hydroxide to sulphurous acid, (3) the effect of temperature on the formation and precipitation of calcium sulphite, and (4) the oxidizability of sulphurous acid and of sulphites.

Mr. Farnell's own experiments on the precipitation of calcium sulphite are next described, with respect to the effect of (*a*) the absence or (*b*) the presence of sucrose, and (*c*) the presence of sucrose *plus* sugar-cane colloids in the sulphurous acid-calcium hydroxide system. In these experiments, the relative effects of time, temperature, reaction (pH value), and concentration, on sulphite precipitation, were studied in detail. The results are presented in tables and in graphs. The main conclusions are as follows :—

(1) Precipitation of calcium sulphite is *favoured* by (*a*) high initial concentration of sulphurous acid and lime in the sulphitation process; (*b*) low concentration of cane-juice colloids, (*c*) high temperature of working, and (*d*) long reaction time.

(2) The presence of *sucrose* exerts no retarding effect on calcium sulphite precipitation, but it greatly diminishes the size of the resulting sulphite crystal-clusters.

(3) The presence of *colloids*, not only retards the precipitation of calcium sulphite, but it also alters the shape of the precipitated grains, rendering them spherical.

(4) The size of these colloid-contaminated spherulites (and consequently, filterability), is increased by rise of temperature and time of working, by high degree of alkalinity, and by high initial concentration of sulphurous acid and lime.

It is recommended as a corollary to these findings, that, in order to precipitate calcium sulphite the more completely, and hence to effect better defecation in white-sugar factories practising the sulphitation process, the final reaction (pH value) to which the hot clarified juice is brought, ought to be pH 7.6 or 7.8 rather than pH 6.8, which is the customary final reaction-figure attained in the average Natal or Mauritius factory. This improved practise should diminish scale-formation, but it would necessitate the employment of filter-presses presenting greater filtration area, in order to cope with the increased amount of precipitated sulphite thereby produced.

Whereas final reactions more alkaline than pH 7.8 are not recommended for *white* sugar manufacture, because they lead to undesirable darkening in colour in the syrups, they may be employed in *raw* sugar sulphitation practise without serious detriment to the products.

In conclusion it may be noted that Mr. Farnell is now completing similar studies to those above-described, on the precipitation of calcium phosphate. He hopes later to extend the work to include calcium carbonate. This should throw more light on the mechanism of carbonatation, which is the main process of defecation practised in modern beet-sugar factories, as well as in certain factories producing high-grade cane sugar.

F. Hardy.

WITHER-TIP DISEASE OF LIMES.

Suggestions for its Control.

Prof. S. C. Harland, D.Sc., F.L.S.

The lime wither-tip disease is caused by an actively parasitic fungus (*Gloeosporium limetticolum* Clausen) which attacks, in their young stages, the leaves, stems, flowers, and young fruits of the West Indian lime.

Severe losses have been sustained by growers of limes in Southern Florida, and spraying methods of control have not been entirely successful there. Infection spreads rapidly during rainy weather, especially on very tender new shoots that are just expanding, on the blossom parts or on the fruit when quite small (less than 3/8 inches diameter), thus making it difficult, if not impossible, to apply with safety a protective coating at the time when most needed.

Clearly the best method of control would be to find a variety of lime immune to attack by *Gloeosporium limetticolum*. This new variety must have the essential features of :—(1)heavy cropping, (2) high citric acid content, (3) characteristic lime flavour, and (4) drop from the tree when ripe. As pointed out by Fulton, the ideal would be to find a naturally immune variety in the present West Indian lime, which is universally propagated from seed.

The disease is very closely confined to the West Indian variety of lime. Other citrus fruits such as orange, grapefruit, lemon, tangerine, &c. are not attacked, and apparently the varieties of lime—Kusaie, Woglum's seedless, Buena Vista, Tahiti and Persian are immune. The thornless variety of Dominica, which originated as a sport from the normal West Indian type is severely attacked. The problem of control may be considered under the following heads :—

1. Selection among the seedlings of West Indian lime in the hope of finding an immune type. The West Indian lime breeds almost true to type,

A few variants have been recorded in Dominica among which the spineless mutant is the most noteworthy. The phenomenon of polyembryony, however, occurs widely in the genus Citrus. The seeds contain a number of embryos only one of which need be the result of sexual fertilisation. The others closely resemble the mother plant or are identical with it. Usually the vegetative embryos are stronger and survive to the exclusion of the sexual product. Does the lime reproduce itself exclusively from vegetative embryos, or is there some sexual reproduction? The only evidence on this point is indirect. The spineless lime is said to throw about 10 per cent. of spiny forms in its progeny. If all the embryos were vegetative, no spiny types would be produced at all. It is, therefore, probable that the spiny plants in the progeny of spineless are the result of natural crossing in the field. The possibility of finding an immune type among natural seedlings is thus seen to depend primarily on the mode of reproduction of the lime, whether sexual or asexual. There is a further point, however. Is resistance to the disease dominant or recessive in the Mendelian sense? If dominant it would mean that the lime must mutate from the recessive to the dominant state, retaining all other characters *in extenso*. Again, there is little positive evidence. Fulton (*Jour. Agr. Res.*) states that certain first generation hybrids of the West Indian lime with the Kumquat proved immune to the disease. Immunity thus behaves as a Mendelian dominant, and the possibility of finding immunity in natural seedlings is thus lessened.

To sum up: it seems unlikely that selection among West Indian lime seedlings will be of any value in the search for a resistant variety.

(2) A survey of the cultivated varieties of limes.

The lime exists in several varieties—Kusai, Woglum's seedless, Buena Vista, Tahiti, and Persian. These are not considered as capable of replacing the West Indian variety, owing to defects in their commercial qualities. The original home of the lime is in the East, and it is there that search ought to be made for new types. The present writer was instructed to pay particular instruction to limes while on a mission to the East, July-December, 1925. A brief survey and enquiry in the Philippine Islands and Malaya were made. The Philippines have apparently been gone over fairly thoroughly by American workers and no very promising new types of lime exist there. In Malaya a small lime is sold in the bazaars of Singapore, and Kuala Lumpur. This is probably not the West Indian lime and is worth getting for a representative collection of lime types.

Going north into Burma a rich field was encountered in the region from Toungoo to Mandalay. Limes are grown quite extensively in the Mandalay district and in the foothills of the Southern Shan States. Several types of lime were obtained in the markets, and these were distinctly meritorious as well as being quite different from the West Indian lime. A consignment was shipped to Trinidad, and it is hoped that it will arrive in good condition. In any case it will now be possible to get continuous supplies.

The sudden increase in the number of varieties of lime in Upper Burma leads to the belief that the cultivated lime originated in this region. It is known also that the lime is widespread in India. Had time permitted the writer would have sought for more varieties of lime in Siam, Indo-China and Assam but it was not possible to visit these countries.

From what has been said above, the position as regards obtaining a lime from the East to replace the West Indian lime is not encouraging, and it is clear that every effort should be made to obtain from Burma and India as wide a variety of types as possible.

(3) Artificial hybridisation.

If no variety of lime exists of the desired type it will be necessary to produce one by plant breeding methods. Hybrids of West Indian lime with other citrus types have been made in Montserrat and Dominica, and the first thing to decide is the extent to which these can reproduce their characters by apogamous embryos, and whether they are capable of being back-crossed to the West Indian lime. If back-crossing can be readily effected it will be possible, after, say, three generations, to obtain a type of West Indian lime, identical with the old except for the new quality of resistance to wither-tip. Too little, however, is known about apogamy in the lime and its nearest congeners, and scientific studies of this question are urgently needed.

GUM COPAL.

ALTHOUGH West African gum copal can never compete to any great extent with Arabic gum, it has its own special place on the European market. If the quality was less irregular and local grading more efficient, the trade would be higher than it is. Wasteful methods of tapping have jeopardised the industry, notably in Sierra Leone, which used to send 30 tons annually to Europe for the making of a certain varnish. The value of gum copal exported from Sierra Leone is high. It sometimes fetches 2*s*. a lb. in the European market.

Copal is obtainable in West Africa from Sierra Leone to the Portuguese Congo. Some of it is soft, from the living trees, a wasteful method of tapping which depletes the forests, but the better kind is hard, from the fossil and semi-fossil trees. Each West African Colony has its own variety, their botanical origin being uncertain. In 1920 the Gold Coast, where the quality is medium, sent 76,560 lb. of copal to the United States and 7,576 lb. to the United Kingdom. The total value was £2,779. Sierra Leone has set up plantations near Moyamba, and the Government of this Colony has taken active steps to preserve and increase the industry.—*Times Trade and Engineering Supplement.*

TROPICAL WORLD NOTES.

Tanganyika.

According to an article in the *African World* the estimated crop of cotton in Tanganyika Territory is for a crop of about 20,000 bales, but the actual output will not be definitely known for several months yet. The distribution of cotton-seed to the natives had been increased from 1,047 tons to 1,594 tons but an estimate of yield is only about the same as in previous seasons. It is possible that this estimate may not be reached as the natives may be discouraged from picking their cotton on account of the low prices. The reduced yield is due to a very unfavourable season which has affected the produce of all the annual crops of the country and caused a severe shortage of food crops. In one district internal boll rot made its appearance and in another the attacks of rats, which dragged the seed-cotton out of the ripe bolls, caused a good deal of loss. In spite of the operation of adverse circumstances it is said that the season will be of value since cotton has come through in a fairly encouraging way. The crop has suffered less than any of the food crops and has shown itself to be a more dependable cash crop than the only other native annual cash crop, the ground-nut.

Cotton has given the native farmer cash to buy the food that the grudging seasons did not yield for him or that his improvidence caused him to sell prematurely and has paid his tax.—*African World.*

East Africa.

Public telegrams and articles in exchange literature make frequent mention of the effects of streams and floods throughout a considerable portion of East Africa during recent months. These have had serious effects on growing crops and on transport, and the difficulties of transport in many districts in East Africa form the chief obstacle to success in the production of crops on a large scale except a few of the most valuable and less perishable.

Particular attention is drawn under these conditions to the need of the adequate bridging of the Zambesi in order to mitigate the interruptions in the traffic taking the crops of Nyasaland to Beira, the port of outlet. This is the second year in succession that the Nyasaland traffic has been disorganised by floods. The Zambesi bridge has been under discussion for some time and the joint East African Board has submitted a comprehensive memorandum to the Colonial Office on the subject of the bridge for the Zambesi at Sena.

The *African World* for 23rd January, gives an article on the memorandum and points out the advantages which would accrue to Nyasaland from the construction of the bridge at that place. It would provide for direct railway communication from Nyasaland to Beira and greatly facilitate the transportation of Nyasaland crops. Increased facility of transport would probably lead to increased production. These railway facilities would also result in increased output of coal from the colliery now being worked in the Zambesi Valley near Tete. It is not contended that the project would prove remunerative and, therefore, it is not a proposition which would invite the investment of private capital entirely, and it is suggested that the British Government should assume liability for this construction and it is claimed that such a project is of such an Imperial nature that the Imperial Government should help and that a portion of the ten million pound loan for East African development guaranteed by the Imperial Government might be applied as financial help towards this construction.

New South Wales.

The control of cattle ticks in different parts of the world and the consequent reduction in outbreaks of Texas or Red-water fever has received a very considerable amount of attention in recent years. Many areas, which were formerly very seriously infested with ticks and where cattle owners suffered great losses both from the direct effect of ticks and from the diseases of cattle carried by them, are now practically free from both ticks and disease. A note in the *Agricultural Gazette* of New South Wales for 1st December, 1925 on the progress of tick control of the north coast indicates that the cattle owners in that locality fully appreciate the value of tick control. During the past year a greatly increased amount of work has been carried out by the Staff of the Board of Tick Control. The number of cattle dipped during the year being more than one million and nearly half a million more than the total for the previous year. It is noted with satisfaction that this vast amount of dipping was carried out without friction, with the minimum of inconvenience to stock and with little or no detriment to the cattle.

One of the most encouraging factors of the year's work was the attitude of the farmers towards dipping. A large amount of voluntary dipping took place. Stock owners have formed themselves into groups and have expressed their willingness to lease the land, supply timber, erect yards, crushes, &c., provided the department would construct the dip, draining pens, &c.

The American system of tick eradication which has produced excellent results is to take an area or county and dip every head of stock in that area at regular intervals for a period of six to eight months. By this method many clean herds may be treated but by dipping every head the clean herds are protected from infestation, while the infested herds are in process of being cleaned. In the Tweed area the American system has been adopted and in the northern section for a whole year the treatment has been regular and continuous, all stock being dipped for 21 days except during the winter months. This system

has practically eliminated the tick from an area in which at least 95 per cent. of the farms were very heavily infested. Another season of such treatment will certainly get rid of the last tick and provide an object lesson of the effects of systematic dipping applied over a large area.

THE ZANZIBAR CLOVE INDUSTRY.

Reference has been made in previous issues of *Tropical Agriculture* to the clove industry of the Zanzibar Protectorate. In Vol. II, No. 4 on page 74 will be found a brief description of the origin and development of the industry which now provides some 90 per cent. of the world's clove requirements. In Vol. II, No. 2 on page 255 reference was made to the unsatisfactory condition of the plantations and the high costs of production. The Annual Report of the Agricultural Department for the year 1924, which has just been received, gives further particulars as to the state of the industry and an account of the remedial measures which have been introduced. High costs of production appear to be the root of the evil. Many of the planters have become impoverished and have fallen into the hands of money-lenders whose high rates of interest have rendered the position of many clove-growers practically hopeless. High costs of production are caused by the high rates paid for task work and the great age of many of the trees which are past their period of best bearing. Since the industry depends to a large extent upon imported labour it is inevitable that rates should be higher than on the mainland, but there appears to be no justification for the exceptionally high comparative rates hitherto paid. The cost of harvesting has increased at a very rapid rate and even doubled within a single year and now amounts to no less than 4d. per lb. of dry cloves. Discussions between the Arab planters and the Agricultural Department resulted in the decision to increase the tasks by 50 per cent. for the same pay. The new scale was introduced on the plantations of the Department—the largest employer of labour in the country—on the 1st September, 1924. Only a few labourers deserted, but they were immediately replaced and many subsequently sought re-employment at the new rates. The Arab Community immediately followed the example of the Department, and the total saving to the country will amount to several lakhs of rupees per annum. The problem of reducing picking costs is much more complicated and general agreement has not yet been reached, but it is expected that the "Masters' and Servants' Decree" which was shortly to be put into operation would result in a material reduction in costs.

The plantations in Pemba, which escaped destruction by the cyclone of 1872, are much older than those of Zanzibar, probably, on the average, 40 years older. The average annual production during 1904-5 to 1913-14 in Pemba was 3,67,309 fraslas, and 3,70,228 fraslas, between 1914-15 and 1923-24 an increase of 0.79 per cent. In Zanzibar the corresponding figures were 1,25,011 fraslas and 1,62,644 fraslas or an increase of 30.10 per cent. It appears that the production of Pemba has reached its maximum, but in Zanzibar some increase may still be expected even without extensive replanting. In view of the existing signs of over-production the situation in Pemba would appear at first sight to be eminently satisfactory. Unfortunately the reverse is the case as the trees are all in practically the same age group and after an unknown but limited period a rapid decline must be expected. Some trees in Amboina are reputed to be over 100 years old, and trees of 80 years of age frequently bear well, but a higher rate of pay is demanded for picking from these old trees, so that their economic life is, therefore, shorter than their natural life. Active regeneration is necessary merely to maintain the clove supply, and for the purpose of encouraging replanting the Government offers a bonus of Rs. 3 for every young tree which is suitably planted and raised to the age of 6 years. Very few growers, however, have suitable land not already under the clove so that regeneration involves the removal of trees above a certain age to make room for new plants. Since ten years elapse before any appreciable return is obtained there is very little inducement to cut down trees still giving even a small yield. The total numbers of trees registered are 1,125,937 in Zanzibar and 1,642,651 in Pemba. During 1924 bonuses amounting to Rs. 2,02,865 were paid on 14, 276 claims in Pemba, and Rs. 1,52,017 on 5,677 claims in Zanzibar. Claims for trees which are undersized or planted on unsuitable soil, or within 21 feet of any other tree, are disallowed. It is as yet too early to gauge the success of the scheme. The problem is difficult and complicated but if the measures of the Government fail to achieve their object it is clear that within a few years the output will decline, perhaps steadily at first, but later at an accelerating rate.

The 1924-25 crop exceeded the estimate on account of more complete picking than usual and satisfactory weather conditions. For the past ten years there has been a regular alternation of large and small harvests and since the 1924-25 season was well above the average it is expected that the 1925-26 crop will be below the average.

C. Y. S.

We have received from the Trinidad Chamber of Commerce (Inc.), a copy of its *Classified Business Directory* showing the various businesses and interests represented in its membership, revised to 1st January, 1926. The first edition issued in October, 1923, proved to be of such utility to overseas suppliers, that it has been decided to revise this Directory every two years in future. We understand that copies can be obtained gratis and post-free on application to the Hon. Secretary, Port-of-Spain, Trinidad.

WEST INDIAN SUGAR.

During the visit of the Parliamentary Delegation to Trinidad, they were invited to a joint meeting of the Agricultural Society and the Chamber of Commerce, when Sir Francis Watts, K.C.M.G., President of the Agricultural Society, read an address on the Sugar Industry in Trinidad and the West Indies, of which the following is a summary.

The Sugar Industry in Trinidad is second only to the Cacao in importance and nearly equal to it in the value of exports. The average annual export value for the past four years has been, for cacao, £1,223,965, and for sugar, £1,155,287. The yield of Sugar, of about 50,000 to 60,000 tons is the product of about 35,000 acres of sugar-cane harvested each year.

In Trinidad, sugar is manufactured entirely in central factories, of which the Usine Ste. Madeleine is the largest, its output in 1925 being 23,520 tons of sugar, or practically one-third of the crop of the Colony. This is the largest sugar factory in the British Empire. A characteristic feature of the sugar-cane industry in Trinidad is that a very large proportion of the sugar-cane produced is grown by small farmers; out of a total of 561,670 tons of cane dealt with in 1924 no less than 237,298 tons were purchased from cane farmers.

Up to the beginning of the nineteenth century the West Indian sugar industry had been on the whole prosperous and of much importance to the inhabitants of the United Kingdom as well as to the West Indies themselves, for the sugar was imported into the United Kingdom where it was refined and distributed for use, not only in the United Kingdom itself, but also on the Continent of Europe, most of the sugar there used coming from England. About the middle of the nineteenth century, beet sugar grown in Europe became a serious competitor, and by about the middle of the century this competition was causing considerable anxiety to the West Indian planters. The production of European beet sugar was carried on under a system of bounties and subventions from the various governments, while British West Indian sugar received no state assistance and was compelled to compete unaided and unprotected against beet sugar heavily subsidized. About 1870, the pressure became serious and by about 1880 it reached such a pitch that many West Indian plantation owners were greatly embarrassed and in the years 1882 and 1883 many proprietors were ruined and many plantations changed hands. The effect of this competition was that the sugar industry of the smaller islands was so seriously crippled that sugar ceased to be produced for export.

British West Indian sugar had previously found its market mostly in the United Kingdom, but the quantity going there steadily diminished, the markets of the United States being found to be more favourable. Under the McKinley tariff of 1890 a countervailing duty of one-tenth of a cent a pound was imposed against European beet sugar, and under the Dingly Tariff Bill of 1897 a countervailing duty equal to the amount of the bounty. The American market then became for a short time the chief and recognised one for British West Indian sugar. The value of this market to the West Indies was lost, however, when, in 1903, a Reciprocity Treaty was negotiated between the United States and Cuba, under which Cuban sugar received preferential treatment in American markets to the extent of 20 per cent. of the duty payable on other sugars.

In 1898, Canada granted preference on British West Indian sugars equivalent to 25 per cent. of the duty payable by other sugars and this was increased to 33⅓ per cent. by the Agreement of 1900. This preference had little effect in diverting British West Indian sugars from American to Canadian ports, for the advantages accruing in the former, owing to the existence of countervailing duties in the United States were of greater value than the Canadian preference, but when in 1903 Cuban sugar was granted preferential treatment in American markets British West Indian sugars were no longer able to compete there and they were speedily diverted to Canada. In 1903, under the Brussels Convention the sugar producing countries of Europe agreed to discontinue the giving of bounties; this led the West Indian planters to feel that they could compete with beet sugar on more equal terms and consequently there was a revival of interest in West Indian sugar production, active steps were taken to improve the factories and to bring manufacturing processes up to date. The development of central factories in the Leeward Islands and Barbados dates from this period, the central factory at Gunthorpe's, Antigua, which was the pioneer of the movement, being erected in 1904. It was hoped that a favourable period for British West Indian sugar had set in, with bounties and preferential treatment established in Canada. These hopes were destroyed by the phenomenal development of the sugar industry in Cuba as the result of preferential treatment in the United States coupled with the influx of large amounts of capital for the improvement and extension of the industry, which rose from a production of 345,568 short tons of sugar in 1899 to 1,118,724 tons in 1902, to 2,719,961 tons in 1912, to 4,035,259 tons in 1922 and to 5,125,970 tons in 1924.

The significance of these figures will be appreciated when it is stated that the world's production of sugar in 1924-25 was 15,507,042 long tons of sugar-cane, and 8,088,176 tons of beet sugar. Cuban sugar of 96° test enjoys preference in the United States to the extent of $14, or £2 18s. 4d. a long ton. The consumption of sugar in the United States in 1925 is estimated at 4,854,479 long tons. As the United States and their Dependencies produced 1,435,452 short tons of sugar, which would be admitted free of duty and, therefore, find a market in preference to Cuban sugar, it follows that Cuba would have to find outside markets for about 1,707,000 short tons of sugar, and it is probable that this amount

will increase. Most of this sugar will be forced on the markets of Canada and the United Kingdom and will thus compete severely with the sugars of British production; indeed, but for the measures of protection given in these countries British Colonial sugar would hardly find a market there. The following figures are significant in this connection :—

	Imported into Canada.		*Imported into United Kingdom.*	
	1923	**1924**	**1923**	**1924**
British Grown	170,780	114,600	321,648	181,240 tons.
Cuban	169,330	78,651	258,900	452,117 ,,

The competition between British West Indian and British-grown sugars on the one hand and Cuban on the other is aggravated by the generally increased sugar production of the world: In 1913-14 the production was 18,436,478 tons, of which 9,801,536 tons were cane sugar and 8,634,942 were beet. In 1923-24 the production of sugar had risen to 19,699,547 tons, of which 13,838,069 tons were cane and 5,861,478 were beet while in 1924-25 it is estimated that the total production of sugar was 23,595,218 tons of which 15,507,042 tons were cane and 8,088,176 tons were beet.

Up to about 1923 the world could readily take the quantity of sugar produced, but the great increase in production of Cuban cane-sugar and of European beet sugar threatens the world with an over-supply, at any rate for a time, in consequence of which sugar prices are now ruling very low.

Preferences granted on sugar benefit not only the West Indian sugar growers, but also those of other British Possessions, including Mauritius, Natal, Fiji, and Australia. Increased sugar production in response to preferential treatment must necessarily be slow on account of the costly machinery required in the modern sugar factories and it is generally conceded that factories must be capable of turning out not less than about 10,000 tons each in order to be efficiently administered, and such a factory may be expected to cost about a quarter of a million sterling and the value of the land required for the production of the canes and the cost of cultivation must also be taken into account.

The six beet sugar factories now under consideration in England are estimated to cost £1,826,000 or at the rate of £305,000 each, and they may possibly cost more. In order to assist growers of beet sugar in the United Kingdom and put the beet sugar industry there, on a stable footing subsidies and preferential treatment are being given to the extent of £21 13*s.* 11*d.* a ton of sugar produced, which is far in excess of the present value of sugar f.o.b. in the country of production. This is in strong contrast with the position of the West Indian sugar growers in the eighties of last century, when contending against bounty fed beet sugar.

The United Kingdom depends largely on foreign sugar, only about 10 per cent. of the sugar imported into the United Kingdom comes from British Colonies; so that while £2,800,000 is paid to British sugar growers for the sugar supplied, about £25,200,000 is expended on foreign-grown sugar. Of the Empire-grown sugar imported into the United Kingdom only about one-third comes from the West Indies and British Guiana. Consideration should be given to increasing the consumption of Empire-grown sugar in the United Kingdom as an Imperial measure calculated to safeguard national interests and obviate dangers such as were experienced during the late war, when the country suffered severely in health and efficiency from the shortage of sugar because of this undue dependence on foreign supplies.

The sugar industry is of importance to investors and manufacturers in the Mother Country; it is largely carried on with British capital, while the machinery employed is largely of British make. The increased foreign interest in sugar is, however, rapidly leading to the introduction of machinery made in foreign workshops.

In addition to having to contend with the difficulties inseparable from agricultural undertakings, such as arise from pests and diseases and the cultivation of the soil under tropical conditions, West Indian sugar producers are faced with many difficulties which they, unaided, cannot remedy, and it is these difficulties and disabilities which were commended to the earnest consideration of the Parliamentary Delegation.

PIASSAVA.

Piassava, for which there is always a ready sale in the European market, is a product which does not receive the attention it deserves in British West Africa.

Piassava has many advantages over jute, a rival fibre; it can be cropped twice in one year and treated as a perennial. It is used for making brushes, mats, stiff brooms, &c., and in appearance is similar to fine whalebone. In the opinion of those who handle the fibre in this country, West African piassava is a product worth cultivating. All supplies find a ready buyer in Great Britain.

Sierra Leone in 1915 exported 1,283 tons of piassava, the price averaging £60 per ton. In 1922 the export had grown to 1,355 tons, and in 1923, 1,620 tons. Only a small quantity comes from the Gold Coast, although there is a good plantation near Axim.

Piassava is produced from the sheath of the leaf stem of *raphia vinifera*, the wine palm. It is prepared in several parts of Sierra Leone, especially in the swampy districts near the coast. Wine is extracted from the tree by tapping the standing or felled trees, in the latter case with the aid of fibre.—*Times Trade and Engineering Supplement.*

CHEMICAL NOTES.

Compiled by the College Department of Chemistry and Physics.

Training of Beet Sugar Technologists.

The report of the Special Committee of the British Sugar Beet Society, called to evolve an education scheme for the training of technologists for beet sugar factories, should interest those concerned in the training of cane sugar technologists. Posts in the British beet factories are to be given to applicants holding the Diploma in Beet Sugar Technology. The basic principle of the scheme is that a course of practical training in a beet factory during the manufacturing season is to be taken *between* the preliminary and the advanced courses given at a University or other approved Institute. In the factory, the following topics are amongst those recommended for special study. (1) Delays, their causes and effects on processes and products; (2) the normal and modified routine followed in the factory, (3) difficulties in treating damaged or inferior beets; (4) faulty work due to negligence of workmen, and its effect on processes and products; (5) breakdown of machinery and plant, its causes and methods of repair; (6) cleaning of machinery and plant; (7) interdependence of the various factory operations; (8) causes and extent of sugar losses; and (9) labour organisation.

It has not yet been decided where the beet sugar technological training will be given, but Birmingham University appears to offer most facilities.—(*Industrial Chemist*, October, 1925, I, 9, p. 418.)

Industrial "Casein" from Soy Beans.

Soy Beans, which contain from 30 to 40 per cent. of protein, and 12 to 18 per cent. of edible fat, largely consumed in China and Japan, are a valuable source of industrial "casein."

The beans are first crushed and pressed to remove the fat, which forms a saleable by-product. Extraction by suitable solvents is a preferable preliminary treatment, because it effects more complete removal of fat. The fat-free residue is next digested with 5 per cent. sodium carbonate solution, at 30° to 35°C for several hours in wooden vats provided with rotary agitators. The mixture is then filter-pressed, and the protein is precipitated from the filtrate by adding hydrochloric acid. It is finally washed and dried at low temperature. Industrial casein is now-a-days largely used as an adhesive in the preparation of cold-water paints and distempers, in paper glazing, textile dressing, water-proofing, and calico-printing. It is also used for making artificial ivory. The chief source of industrial casein is skim milk, but apparently soy bean protein is so similar to milk casein that it can be used for the same purposes.—(*Industrial Chemist*, June, 1925, I, 5, p. 250.)

Soil inoculation with nitrogen-fixing bacteria.

The very rapid loss of nitrogen from virgin soils, especially tropical soils, when brought under cultivation, accompanied by a corresponding decrease in productivity, has rendered important every investigation which aims at compensating this depression. In particular, the question of introducing nitrogen-fixing bacteria into soils in which these organisms are absent or scarce, possesses great economic significance. Early attempts to overcome the difficulties inherent to such attempts, have generally been unsuccessful, chiefly because information relating to the essential conditions for the existence and multiplication of nitrogen-fixers, was lacking. In recent years, however, this deficiency has been largely corrected, especially through the work of certain American soil bacteriologists, notably Dr. P. L. Gainey of the Kansas Agricultural Experiment Station. In a recent paper in *Soil Science* (July, 1925, 20, 1, p. 73), Dr. Gainey outlines his methods of experimentation and his chief results. Among other things, he has shown that the growth of *Azotobacter* (which is the commonest of the nitrogen-fixing bacteria in soil), depends very exactly on the reaction of the soil. Thus he was unable to establish an *Azotobacter* flora in soils more acid than pH 6.0, but he found it possible to establish the bacterium permanently in soils originally more acid than pH 6.0 by adding basic substances such as calcium carbonate and magnesium carbonate, before inoculation. In these cases, the fixation of nitrogen was increased by two to two and one half times.

Manufacturing of Calcium Citrate and Citric Acid.

In the December, 1925, number of *Industrial and Engineering Chemistry*, p. 1283, are described the results of a laboratory study, undertaken in the Leeward Islands Laboratory, Antigua, B.W.I., by F. H. S. Warneford and F. Hardy, of the exact conditions of precipitation requisite to the production of high-grade calcium citrate from lime juice. The usual West Indian method of making calcium citrate by adding lime cream to *hot* lime juice, was found to be not so satisfactory as liming the juice *cold* and then heating. The cold-liming process yields a product which can easily be cleansed of colouring matters by washing with water, whereas the hot-limed product is not easy to purify.

Two new processes for manufacturing pale citric acid syrups (of possible use in the "soda-fountain" trade), and colourless citric acid crystals, by the employment of Norit (a vegetable char) are described. The details are too lengthy to be set out here, but copies of the article under review will be supplied free on application to anyone interested in citrus products manufacture. Requests should be addressed to the Department of Chemistry, Imperial College of Tropical Agriculture.

COTTON RESEARCH STATION.

The Cotton Research Station of the Empire Cotton Growing Corporation was described, and its objects set forth in two articles in *Tropical Agriculture* during 1925. That in the August number (p. 185) referred to the visit of Professor (now Sir) J. B. Farmer and Mr. L. G. Killby to report on the suitability of Trinidad for the purpose of establishing such a Station, and the selection of a site near the College. The second article which appeared in the October number (p. 226) referred to a summary of the report by Professor Farmer and Mr. Killby, with a foreword, reproduced in *extenso*, by Dr. W. L. Balls reviewing the history of the movement which has resulted in the establishment of the Station. The Introduction also given in full in the article referred to, explains what are, and what are not, the objects of the Station.

At the time of the present writing the work on the development of the Research Station is well advanced. When the land was acquired some of it was under cacao, some under coconuts, and the remainder, the larger part, was open pasture which had grown up to bush. The land has been cleared and most of it has been planted with sugar-cane which, it is expected, will yield some cash return, and will be the means of putting the land into good condition for the planting of cotton at a later date. A sufficient area of cleared land has been left for the planting of cotton for immediate needs, with the advent of the wet season in May or June next. Roads have been laid out and metalled, surface drains made, a water supply located, and fences erected.

Four houses of the bungalow type have been built and are nearing completion. Two of these are being used for residences and two as laboratories. Another house is to be built, and this, with a house on the Station, completes the accommodation for residence of the Staff.

Appointments have been made to the Staff of the Station as follows: Dr. S. C. Harland, D.Sc., F.L.S., F.E.S., Geneticist, Dr. T. G. Mason, D.Sc., M.A., B.Agr., Plant Physiologist, Dr. E. J. Maskell, Assistant Plant Physiologist and Mr. J. B. Hutchinson, B.A., Assistant Geneticist.

Dr. Mason was formerly Professor of Botany at the College, and more recently Economic Botanist to the Government of Nigeria. Mr. Hutchinson, who held a Post-Graduate studentship under the Empire Cotton Growing Corporation, was a student at the College during the 1924-25 session. Dr. Maskell has recently been engaged in research work in plant physiology at the Rothamsted Experiment Station, Harpenden, Herts., England.

The work of laying out and developing the Station has been under the direction and supervision of Mr. W. Nowell, Assistant Director of the Trinidad Department of Agriculture, while the planning and building of the houses has been under the direction of Dr. H. M. Leake, Principal of the College.

OBITUARY.

It is with great regret we announce the death of William Bateson, M.A., F.R.S., V.M.H., Director of the John Innes Horticultural Institution, Merton, Surrey, which occurred on the 8th February. William Bateson was the son of the Rev. W. H. Bateson, D.D., Master of St. John's College, Cambridge, to which College he proceeded on leaving Rugby. Born in 1861 he was early attracted by the problems of Variation and had already grasped the importance of recording facts if the study of Variation was to be advanced. His "Materials for the Study of Variation" appeared in 1894 a few years before the discovery of Mendel's papers and his quick mind was one of the first in England to grasp the significance of that work. At Cambridge where he ultimately became Professor of Biology he built up the Cambridge School of Genetics. From 1910 till the time of his death he held the post of Director of the John Innes Horticultural Institution at Merton, where he has built up a School of Genetical Research which has become famous. The wide range of genetical work which Mendel's results stimulated soon led to the discovery that the phenomena of inheritance were not invariably to be interpreted as simply as at first appeared likely. The fact that characters are frequently linked required explanation. The American School, with the work on Drosophila forming the main basis, has evolved a *cross over* theory to explain linkage. This Bateson accepted, but it was clear that he was not entirely satisfied. For more than ten years he had inclined to the view that segregation might be a somatic as well as a reproductive phenomena and a large part of the work carried out at the John Innes Horticultural Institution deals with forms of asexual variation. His efforts were in fact directed to determine the facts of segregation and in the last issue of the Journal of Genetics appeared a summary by him of this work. His loss will long be felt in the English School of Genetics.

FUNDS FOR RESEARCH.

The urgent deficiency appropriations bill now before Congress carries an additional $25,000 for sugar research work at the Bureau of Standards. This sum will become available as soon as the bill is enacted into law and will be used during this fiscal year and next, to supplement the regular appropriation for the bureau's sugar work, which amounts to $38,140. The larger funds available will permit expansion of the experiments on sugar extraction from artichokes.—*Facts About Sugar.*

The subscription to *Tropical Agriculture* is six shillings per annum, post free, to all countries within the British Empire or seven shillings, post free, to all other countries. Subscriptions can commence at any time during the year.

THE AVOCADO.

AN article on Avocado culture in Florida by T. Ralph Robinson of the Bureau of Plant Industry of the United States Department of Agriculture appears in the November-December, 1925 number of *Florida Fruit and Flowers*, from which the following notes are taken.

All varieties of avocado thus far studied fall into two classes, one having flowers ready to be pollinated in the morning and shedding pollen from a second set of flowers in the afternoon, and the other having a reverse flower behaviour. It is recommended that in commercial planting varieties representing these two classes should be planted in adjoining rows; this would result in more efficient pollination than if large lots or varieties of one or other of these classes were planted. It is necessary in this connection that the trees should have approximately the same blooming periods.

Avocado trees in Florida are seldom grown as seedlings, usually being propagated by shield budding. The whip, saddle or cleft grafting may also be used and the latter is capable of being applied to seedling sprouts while quite small. Old seedling trees can be top-worked to the best standard varieties by cutting half or more of the main limbs back to short stubs in the autumn and budding the shoots very early in the spring by the shield budding method. For successful avocado culture the site should be carefully selected with reference to good air and water drainage. Low areas or pockets in which cold air might settle on frosty nights should be avoided. Good water drainage is essential and protection from wind should be provided in all exposed sites. The avocado can be successfully grown on a wide range of soils but prefers a rich sandy loam. On light soils the trees are planted about 20 feet by 20 feet and on rich soils 25 feet by 25 feet or even more distance may be allowed. The holes in which the trees are to be placed should be dug and manure or other organic matter put in some time before the trees are planted. When the trees are set out the bud union should be slightly above the surface of the ground and the soil packed firmly down in contact with the roots. If planting is done during dry weather, the trees should be watered until they are well established and the young trees should be shaded for some time. An occasional application of Bordeaux mixture is desirable as precaution against the particular fungus found fatal to young trees. Some methods of caring for the soil should be planned which will conserve moisture and fertility and add humus. Clean cultivation the year round has been found unsatisfactory as it destroys too much of the humus. Clean cultivation through the dry season and the growing of cover crops in the rainy season, these to be turned into the ground in the autumn, has given very good results in a number of avocado groves. In others a system of permanent mulching is used with excellent success.

Avocados are heavy feeders and must be well fertilized for best results to be obtained; as a general rule the trees should be fertilized four or five times the first year after planting giving them at each application a pound of fertilizer containing about five per cent. of phosphoric acid, and three or four of nitrogen, and six or seven per cent. of potash. This amount may be increased to two pounds per application in the second year and gradually increased until the trees reach full bearing size when they should receive from thirty to sixty pounds of fertilizer annually. The nitrogen used for this purpose is best derived from organic sources such as guano and tankage, rather than from nitrate of soda or other inorganic forms. Additional applications of stable manure or other fertilizer containing large amounts of organic nitrogen may be made with much advantage. It is difficult to overfeed an avocado tree.

The avocado requires an abundant supply of water and under Florida conditions some facility for irrigation is highly desirable. Most varieties of avocados require but little pruning if properly headed at planting time. Later pruning will consist largely in removing weak or undesirable growth.

Avocados are attacked by several insect pests and fungoid diseases but their control has been fairly well worked out. The red spider which is injurious in dry weather may be checked by spraying with commercial lime-sulphur solution (1-70) or with sulphur dust. Attacks of scale insects and white fly may be controlled by the use of oil emulsion sprays in the dormant stage. Avocado scab and "black spot" are the most serious fungous troubles and these are controlled by the use of Bordeaux mixture (3-3-50) two or three applications usually being sufficient. "Die-back" or "leaf-curl" are usually checked by mulching, watering or heavy manuring.

The main harvest season extends from July to December but when the very late Guatemalan varieties now being planted come into bearing the avocado season in Florida will extend through most of the year. The fruit is picked when full grown and mature but before it begins to soften on the tree. Careful grading is necessary in all harvesting and picking operations not to bruise or injure the fruit and as it has been found that such injuries are the cause of most of the decay in transit to market.

When carefully picked, graded and packed and promptly shipped, avocados carry in excellent condition from Florida to the most distant markets in the United States. Only fully developed and perfect fruit should be shipped, all injured and immature fruits should be discarded or used for local consumption.

The Editor requests that any subscriber who fails to receive *Tropical Agriculture* regularly should communicate with him immediately in order that the matter may be rectified.

REVIEWS.

"Report of the Food Investigation Board" for the year 1924. Department of Scientific and Industrial Research, H.M. Stationery Office 1925 pp. vi+80. Illustrated, Price 3*s*. 6*d*.

This report is the seventh issued by the Board and covers in some detail the work carried out in 1924 For further details the Special Reports, a list of which is appended to the report, must be consulted.

The difficulties attendant on the storage of beef are well known. They lie in the irreversibility of process of crystallisation of water from colloidal solutions and the phenomena of such crystallization have had to be investigated. Methods for the preservation of eggs is another line of investigation covered by the work of the Board.

Undoubtedly, however, the subject of most interest to producers in the tropics is the preservation of fruit. The work is largely confined for the present to apples but, on the economic side, the investigation of the engineering problems associated with the transport of fruit have a direct bearing on shipping conditions.

H. M. Leake.

Principles of Marketing, by Fred E. Clark, Macmillan Company, New York 1925, xiii+570, and Readings in Marketing, by the same author and publishers, 1924, xx+705.

In the *Principles of Marketing* the author treats his subject from a functional standpoint, analyzing the various fundamental problems and mechanisms of marketing, introducing details concerning different phases of the marketing of particular commodities purely for purposes of illustration. The author discusses the various methods of marketing farm products, raw materials and manufactured products and examines the functions of the various wholesale middlemen and retailers involved in their distribution. The theories develop into a discussion of the various methods of co-operative distribution and the so-called "elimination" of the middlemen. Consideration is given to the various functions performed by the middlemen such as transportation, handling, storing, the provision of credit facilities, the absorption of risk and the provision of market news. A description is given of the advantages derived from standardisation of products and the progress so far achieved in this direction. The factors determining market price are analyzed in relation to conditions of supply and demand, reference being made to the determination of monopoly price. From an analysis of the vexed question of Governmental interference in marketing, the author arrives at the conclusion that such action must remain an essential part of the mechanism for facilitating marketing and protecting both producers, middlemen, and consumers from the evils of extreme competition and monopoly. In the concluding chapters the author furnishes the reader with a criterion for judging marketing efficiency and examines the costs of marketing certain commodities, showing the conditions under which these would increase or decrease. The book is written in an easy, though analytical style, which will appeal particularly to those whose main requirement is a firm grasp of the main principles underlying the existing methods of marketing. Professor Clark gives us a clear exposition of how the system works and provides the reader with criteria for examining whether and why, in particular cases, the system works well or badly.

Since the treatment of this book is functional it follows that it will have a smaller appeal to those who desire a description of the methods of marketing particular commodities. This inevitable deficiency is met in the same author's *Readings in Marketing*, but since this book is not primarily concerned with the marketing of tropical products the reviewer does not propose to discuss it further, except to say that it forms an admirable companion to the *Principles*.

C. Y. Shephard.

The Royal Economic Society has decided to publish, from time to time, special numbers of the Economic Journal entirely devoted to Economic History. This series will be quite distinct from the usual quarterly issue of the Journal. The first issue of the new series was published in January, 1926 and, from the wide diversity of the subjects included, it would appear to have met a long-felt want. It is to be hoped that these Journals will occasionally contain articles of interest and importance to the tropics. Copies are issued gratis to Fellows, but to other subscribers the price is 6*s*. per issue. The Council has not yet decided at what intervals of time these numbers will appear. Communications should be addressed to the Secretary, Royal Economic Society, 9, Adelphi Terrace, London, W.C.2.

SEED CORN TREATMENT.

The following note taken from *Facts About Sugar* appears to be from the Pennsylvania Bureau of Plant Industry—Crop Protection Inst. Circ. Vol. 5, No. 1, 1st Jan., 1926.

A summary by Dr. G. H. Godfrey, Plant Pathologist, of papers read at recent phytopathological meetings at Kansas City by representatives of the Illinois Agricultural Experiment Station and the Bureau of Plant. Industry, United States Department of Agriculture, discussing the treatment of seed corn with organic mercuries for the prevention of seed borne disease, such as *Diplodia zeae* and *Gibberella saubinetti*. Increases in yield of corn as high as 50 per cent. are reported from the treatment. These diseases cause heavy losses of corn in Louisiana, as well as in the Corn Belt states and in the East, and if improvements in yields such as have been reported can be shown generally, it would appear that the treatment of seed should become a regular practice.

COLLEGE NEWS.

Dr. C. L. Withycombe, PH.D., M.SC., D.I.C., Lecturer in Zoology and Entomology is leaving the College at the end of the present session, having been appointed Lecturer in Entomology at Cambridge University.

The Report on the Imperial College of Tropical Agriculture for the Session 1924-25, by Dr. H. M. Leake, Principal, is given n full in the present number of *Tropical Agriculture*. The Report, which appears also in the College Prospectus for 1926-27, gives a general survey of the activities and progress of the Institution.

Dr. H. Martin Leake, Principal of the College is expected to sail for England by the s.s. *Motagua* on 16th March. Dr. Leake goes to England at the instance of the Governing Body to discuss matters connected with the affairs of the College and expects to return to Trinidad before the end of the present College Session.

Dr. H. R. Briton-Jones, PH.D. (Lond.), D.I.C., A.R.C.S., has been appointed Professor of Mycology in succession to Professor Ashby, and is expected shortly to arrive in Trinidad to take up his duties. Dr. Briton-Jones held the post of Mycologist under the Ministry of Agriculture, Egypt, from 1919 to 1922 and from 1923 to the present time has been Mycologist at the Agricultural and Horticultural Research Station of the University of Bristol at Long Ashton, England.

Sir Edward Davson who is a member of the Governing Body of the College has resigned his position as President of the Associated Chambers of Commerce of the West Indies on his appointment as Chairman of the Imperial Council of Commerce. Sir Edward Davson is a member of the Imperial Economic Committee which he is representing on a visit to West Africa, in connection with the inquiry, nto the development of the production of food-stuffs in the West African Colonies.

Professor S. C. Harland has been appointed Head of the Department of Genetics on the Staff of the Cotton Research Station of the Empire Cotton Growing Corporation at St. Augustine, Trinidad. Dr. Harland's appointment is to date from 1st May next, but he will carry on his duties as Professor of Botany and Genetics until the end of the present College Session in June. Other appointments to the same Staff are: Dr. T. G. Mason, Head of the Department of Plant Physiology, who is expected to arrive in Trinidad on 13th March, Mr. J. B. Hutchinson, Assistant Geneticist is also expected to arrive in Trinidad on 13th March, and Dr. E. J. Maskell, Assistant Plant Physiologist who will leave England on 17th April, for Trinidad.

Visitors to the College recently have been: The Duke of Atholl and party, including Sir Campbell Stuart, Managing Director of the *Times*, to whom we in error referred in our last issue as a Special Correspondent of the *Times*, Colonel Clerk-Rattray and Mrs. Clerk-Rattray, Miss Wills, Miss Lynch, Mr. Marshall and Dr. Viret. The Duke of Atholl it may be mentioned is associated with the College as Chairman of the Lord Milner Appeal Fund for the College. Lord Buxton, who was accompanied by His Excellency Sir Horace Byatt; Lt.-Col. Sir James Reynolds, formerly Vice-President of the Liverpool Cotton Association and Miss Reynolds; Mr. A. H. Stockley, Director of Messrs. Elders and Fyffes, Ltd., and Mrs. Stockley.

The installation of the College Gas Plant has now been completed and the tests already made indicate that it is in good working order. Sir Alfred Mansfield,Director of the firm of Mansfield and Sons. Ltd., gas engineers, Birkenhead, England, Manufacturers of the plant, who is on a visit to Trinidad for health reasons, is taking the opportunity of inspecting the installation and advising as to its working, and any special point in its adaptation to the needs of the College. The thanks of the College are due to the Manufacturers for liberal discounts on the purchase price of the plant, and the timely visit and keen interest of Sir Alfred Mansfield should be productive of valuable assistance in the future management of the gas plant.

BENNISEED.

Unlimited Possibilities.

THE trade in benniseed—or, to give it its more picturesque Indian or East African name, sesame seed—is in its infancy as a West African industry. Gambia, Sierra Leone and the Gold Coast have not yet seen its possibilities, but Nigeria has paid attention to it, particularly in the Southern Provinces.

The seed is the product of an annual herbaceous plant, *Sesamum indicum*, and it forms an important source of edible oil in Europe and is easy to crush. Its yield of oil is high and the quality is excellent. The Continental oilseed crushers favour it more than the British, perhaps because of its compulsory addition to margarine and other edible oil products. Benniseed has a property which by a simple chemical colour test reveals the quality of the butter in which it is used and thus prevents fraudulent sales.

The possibilities of the trade in West Africa are practically unlimited, as the seed crushers on the Continent will take all they can get, even when there is no demand for it in the United Kingdom. Benniseed is dealt with almost entirely in France by the oil mills as a nutritious cattle cake. Nigeria exported 481 tons in 1900, 1,433 tons in 1922, and 2,988 tons, valued at £49,622 in 1923. The oil extracted from Nigerian benniseed is of a clear yellow colour, has no smell, and is capable of being preserved for a long time without becoming rancid. It mixes well with olive oil. The farmers of Bauchi, Kabba, Kano, and Zaria are beginning to cultivate the tree.—*Times Trade and Engineering Supplement.*

THE IMPERIAL COLLEGE OF TROPICAL AGRICULTURE.

REPORT FOR THE SESSION 1924-1925.

By Dr. H. Martin Leake.

The Academic Year 1924-25 constitutes the third in the life of the College and with it the first students to have completed the Diploma Course pass into the World.

I arrived in Trinidad on 23rd August, 1924, so that the year under review covers almost exactly my first year of occupancy of the post of Principal. Sir Francis Watts, K.C.M.G., my predecessor, took leave preparatory to retirement on 7th July, 1924, and retired on 31st October, 1924. The College is the realisation of schemes which he had long carried in his mind and which he, happier than many another, was enabled to see reach their fruition during his active career. This is not the place to give a record of his services. As first Principal of the College he served it for two years and we wish him well in his retirement.

There has been no increase of the staff and only one change in the personnel, Professor W. R. Dunlop resigned on 30th September and Mr. C. Y. Shephard, B.Sc. (Econ.), joined the staff as Reader in Economics to be subsequently promoted to the post of Professor of Economics on 10th July, 1925.

The Entrance Examination, which had hitherto been held for the admission to the Diploma Course of students who did not possess any accepted qualification, and which had proved unworkable in practice, was discontinued and replaced by a system of recommendation. During the course of the year the methods of selection for admission have been further explored and the results incorporated in the Prospectus for 1926-27. The matter is not a simple one in view of the Imperial nature of the College and the fact that students may come from all over the globe. Already we have students admitted on Canadian and South African qualifications while enquiries have been received from India, Malaya and Australia.

Admissions to the Diploma Course for the Session 1924-25 were 6, making a total in the College of 18. In addition 12 students, of whom 6 were sent by the Empire Cotton Growing Corporation and 4 by the Colonial Office, joined the College to take a Post-graduate Course while 4 joined to take a special one-year course.

The first final Diploma examination was held in June, 1925, when 7 students appeared and 5 qualified for the Diploma. Of these 1 has secured employment in Barbados, 1 in Guadeloupe, while 2 have returned to take a fourth-year course.

Of the leaving post-graduate students 4 have taken appointments in the Gold Coast, 2 in the Sudan, 2 in South Africa, and 1 in Ceylon. One is joining the recently established Cotton Research Station in Trinidad and 2 are employed on Trinidad estates. Of the Special Students 2 remain on at the College to take a further course, while 1 has secured employment in a local sugar factory. The total number of students in residence was therefore 34.

During the year the conditions for the Associateship have been laid down and the first Associateship has been awarded to Mr. J. C. Hopkins. Post-graduate students who have already left are now eligible for the Associateship.

RESEARCH AND INVESTIGATION.

In view of the strength of the staff which has to meet the needs of a three-year Diploma Course as well as advanced courses for post-graduates, the amount of research carried out is necessarily limited. The major items, however, are the following :—

1. Bananas.—An informal committee has been established from the combined staffs of the Department of Agriculture and the College to study the entire problem of Banana cultivation and the trade. The prime consideration is the production of a banana immune to Panama Disease and at the same time acceptable to the trade. Trial shipments have been made with the Giant Fig and efforts have been made to raise bananas from seedlings. Before the end of the year under report Dr. Harland with the same object in view and through the kind financial assistance of the Imperial Research Committee, started upon a tour to the Eastern Hemisphere to study the banana. A cytological investigation has been undertaken which has shown a varietal difference in the chromosome number.

2. Sugar.—An investigation limited by the area available on seedling canes especially with regard to milling capacity has been undertaken. The main investigation, however, concerns the froghopper pest of the canes in Trinidad. A considerable amount of detailed work on this subject is being carried out by the Entomological section. This work aims at tracing the relationship between host and parasite especially with a view to determining the causes of differential susceptibility. A suggestive paper on the subject written by Dr. Withycombe is now in the press.

3. CACAO.—The present estate is not suited to cacao cultivation and such work on this plant as has been undertaken is limited to observations on the inheritance of the pod colour and of the axil spot. In addition the incidence of natural cross-fertilisation has been determined. On the cytological side an investigation on the fertilisation and embryology is in progress. On the chemical side the non-volatile acids of Cacao seed pulp and Cacao sweating have been determined. In collaboration with Dr. Nierenstein of Bristol University investigations have been carried out on the catechin and tannin content of Cacao beans at different stages of growth.

4. COTTON.—The work on this crop may be divided into several sections. For practical use attempts are being made to evolve an Egyptian cotton with the staple of Jannovitch and suited for growth in the West Indies. There appears an opening for a plant which would have a more certain market than the Sea Island now grown. Attempts are also being made to improve the staple of the Marie Galante perennial cotton. An investigation on the effect of different water supplies on the characteristics of the lint has also been undertaken while genetic investigations on various characters of the cotton plant are under conduct. The cotton stainer has received further study with special relation to variability in connection with migration.

5. TOBACCO.—A number of varieties of tobacco have been cultivated mainly with the object of ascertaining the possibilities for the production of nicotine and of the varieties best suited to meet the manufacturing trade requirements.

6. CITRUS.—In the absence of a suitable area this crop cannot be grown. Work on this crop is therefore limited to the chemical investigations noted below. Dr. Harland is, however, using the opportunity of his tour to study the crop in other parts of the world especially with a view to securing a form of lime resistant to withertip.

7. MINOR CROPS.—A general study has been made on the minor crops of the island and in particular a genetical study of Ricinus, Dolichos and Vigna has been in progress throughout the year.

8. DISEASES.—In addition to general work on plant diseases some of which have been indicated above, work has continued on the American Leaf Spot of Coffee, the Mosaic Disease of Cane and the Bud rots of the Coconut palms. Numerous identifications of insects and fungi have been made for officers of the Agricultural Departments of the Lesser Antilles.

9. SOIL INVESTIGATION.—The central investigation on soils refers to Tropical Lateritic Soils and a wide range of samples of such soils is being collected for investigation. This work involves an extensive study of basic and acidic exchanges in such soils.

10. BIOCHEMISTRY.—Papers have been prepared by Professor Hardy and Mr. Warneford on The Colouring Matter of Lime Juice and on The Manufacture of Calcium Citrate and Citric Acid from lime juice and these are now in the press.

PUBLICATIONS.

1. "TROPICAL AGRICULTURE."—This monthly Journal which is the organ of the College, has appeared regularly throughout the year. It has gradually expanded till now a number contains 28 pages of reading matter. A policy has been adopted of securing contributions from persons of authority in their special subjects and a number of correspondents are gradually being secured in the various Tropical Colonies and Dependencies of the Empire. By these means it is hoped not only that the interest of the Journal will be maintained but that a consecutive account of agricultural development in such territories will be provided.

2. The scheme for starting a series of publications in the nature of Memoirs to contain the scientific results of work on Tropical Agriculture is in abeyance owing to financial stringency. Pending the institution of such a series, papers are submitted to the standard Journals. During the year under report the following papers have appeared :—

1. "Sugar Cane Mosaic." S. F. Ashby. Proc. Imp. Bot. Conf. 122-131.
2. "Bud rots of the Coconut Palm in the West Indies." S. F. Ashby, Proc. Imp. Bot. Conf. 151-158.
3. "Researches on Panama Disease (Bananas)." S. F. Ashby, B.Sc., Proc. West Ind. Agric. Conf. 51-53.
4. "Three serious Cane Diseases not yet reported from the British West Indies. (Gum Disease, Fiji Disease, Stripe)." S. F. Ashby. Proc. West. Ind. Agric. Conf. 84-89.
5. "Red Ring Disease (coconut)." S. F. Ashby, B.Sc., Proc. West Ind. Agric. Conf. 164-169.
6. "Withertip and Blossom Blight of Limes." S. F. Ashby, B.Sc., Proc. West Ind. Agric. Conf. 172-176.
7. "The Perfect Form of Stilbum flavidum. Cke." S. F. Ashby, B.Sc., Kew Bulletin. 8, 1925.
8. "Insect Pests attacking Cotton." H. A. Ballou, M.Sc., Proc. West Ind. Agric. Conf. 71.
9. "Bananas from Seed and Variety Experiments at the Imp. Coll. Trop. Agric." J. S. Dash, B.S.A., Proc. West Ind. Agric. Conf. 53.

10. "The Guadeloupe Experiment Station." J. S. Dash, B.S.A., Proc. West Ind. Agric. Conf. 99.
11. "The new volatile Acids of Cacao Seed Pulp and Cacao Sweatings." F. Hardy, M.A., Journ. Soc. Chem. Ind. Vol. 44. No. 25. p. 305.
12. "Studies on Cacao. 1. The method of Pollination." S. C. Harland, D.Sc., Proc. West Ind. Agric. Conf. 61.
13. "Botanical Notes on Sugar Cane." S. C. Harland, D.Sc., Proc. West Ind. Agric. Conf. 89.
14. "Rainfall and Crop Yield in the Tropics." H. M. Leake, M.A., Sc.D., F.L.S., &c. Report of Proc. Imp. Bot. Conf. 1924. 17.
15. "The Imperial College of Tropical Agriculture." Sir Arthur Shipley, G.B.E., LL.D., &c., Proc. West Ind. Agric. Conf. 184.
16. "Presidential Address." Sir Francis Watts, K.C.M.G., D.Sc., &c. Proc. West Ind. Agric. Conf. 180.
17. "Further Notes on the Biology of Some British Neuroptera." C. L. Withycombe, Ph.D., M.Sc., Entomol. 1924, LVII. pp. 145-154.
18. "Factors influencing the Control of Cotton Stainers. (*Dysdercus spp.*)" C. L. Withycombe, Ph.D., M.Sc., Bull. Ent. Research, 1924, XV. p. 171.
19. "Some Aspects of the Biology and Morphology of the Neuroptera : with special reference to the immature stages and their possible phylogenetic significance." C. L. Withycombe, Ph.D., M.Sc., Trans. Ent. Soc. London. 1924. 25. pp. 303-411.
20. "A Contribution towards a Monograph of the Indian Coniopterygidae." C. L. Withycombe, Ph.D., M.Sc., Dept. Agric. India, Mem. Entom. Sec. 1925. No. 1.

In addition to the above the staff have contributed freely to the pages of *Tropical Agriculture*.

LIBRARY.

The Library has yet to be catalogued and this is impossible until the New Building accommodation becomes available. It requires considerable addition before it will be worthy of the institution. The major requirement is sets of the proceedings of the various scientific societies and the more important journals. Unfortunately the price of such sets has risen appreciably and a sum of £10,000 will be required before the library can be considered well equipped to serve the functions the College has in view.

THE SUGAR FACTORY.

The splendid factory, the machinery for which forms the gift of the Sugar Machinery Manufacturers of England, was completed during the year and was ready in time to run its first season in the Spring of 1925. Throughout it worked well and was remarkably free from stoppages. It ran for 74 working days, throughout most of that time working 24 hours per day grinding 2,600 tons cane and delivering 246 tons sugar. It is with the utmost regret that I have to refer to the death of Mr. Berthon, the designer. Had he lived he would, without doubt, have seen a development which will go far to promote the sugar interests of the Empire.

Six students took the preliminary course in Sugar Technology.

ADMINISTRATION.

1. The year has ended with the New Building still in the hands of the Contractors. The Building is, however, practically complete and will shortly be ready for occupation. Meanwhile progress has been made with the laying out of the estate.

2. The increase in number of students raises in urgent form the need for a hostel. Accommodation in the neighbourhood is limited and by no means easy to arrange ; a hostel is the only solution to the problem. Plans are in preparation and financial provision alone is required to proceed with the work.

3. A considerable area of the estate has been brought under cultivation but it is only sufficient to grow specimens of the various crops studied. Agriculture is, no doubt, primarily the cultivation of crops but it is also concerned with the production of crops under economic conditions. Students who leave the College should possess a practical knowledge of this aspect and it can only be obtained if, attached to the College there is an estate run on business lines, growing a wide variety of crops and demonstrating a system of tenancy. Fortunately the College is situated in a tract where such conditions are obtainable and finance alone prevents the development of this essential feature.

4. Finance again restricts the activities of the College in another way. Three of the sections of the College, Agriculture, Economics and Mycology are staffed by a single officer while in the remaining sections there are two officers. The Professor of Economics, in addition to his primary function, also performs the duties of Editor and Librarian. In the three former sections, and especially the Economic section there is absolutely no reserve to meet leave and illness both matters of added importance in a tropical country and where leave means a visit to England. An expansion of the staff to form a leave reserve and to meet cases of illness is an urgent requirement.

TREND OF THE MARKETS.

[*The notes below are based principally upon running charts of the prices of the basic grades and upon general statistical information gleaned from contemporary publications and cablegrams and are intended to be a record of movements. An attempt is made, where possible, to indicate the market outlook at the time of going to press, but no responsibility for the accuracy and subsequent truth of such observations is assumed. Unless otherwise stated the prices quoted are spot, London.*]

SUGAR.—Stocks in London are still heavy and have continued to depress prices in buyers' favour. Foreign sugar of 96° c.i.f., which had reached 11*s.* 10½*d.* per cwt. in London on 8th February, has now (9th March) touched 11*s.* 1½*d.*, according to cabled reports. British preferential sugar of 96° c.i.f. declined during the same period from 15*s.* 4½*d.* to 14*s.* 9*d.* per cwt., in each case duty remaining unpaid. Yellow crystals landed and duty paid realised 23*s.* 3*d.* to 25*s.* 6*d.* per cwt. showing practically no change. In New York, Cuban sugar of 96° c.i.f. was quoted at $4.05 per 100 lb. on 9th March. It is estimated that the area under beet in England will reach 124,000 acres this year assuming that all contracts are completed, compared with 84,000 acres last year.

COTTON.—After a spurt to 10.95*d.* per lb. on 16th and 19th January cotton has shown a tendency to decline with minor day-to-day fluctuations. On 17th February Middling American touched 10.30*d.* per lb., but subsequently rose to 10.46*d.* the following day. Business has been small. Reports suggest that large unsold stocks of good quality cotton are being held in the South. Apparently the holders are becoming anxious and require advances to meet their new crop preparations so that a lower basis may be anticipated. It is believed that there are over 3,000,000 bales still to come "into sight." West Indian Sea Island Cotton c.i.f. was quoted at 3*s.* 6*d.* per lb. in England on 9th March.

COCOA.—With the exception of Accras, cocoas have declined in price since our last report. Ceylon ordinary which was quoted at 102*s.* 6*d.* per cwt. in London on 20th January declined to 100*s.* at the end of the following week and remained at that level on 17th February. Trinidad similarly moved from 77*s.* 6*d.* per cwt. to 75*s.* per cwt. and Grenada Fine from 67*s.* 6*d.* to 65*s.* Accras on the other hand rose from 37*s.* 6*d.* per cwt. on 13th January, to 40*s.* on 20th January and subsequently rose to 41*s.* 3*d.* by 17th February. London market reporters express their opinion that the quality of Accras is "slowly but without break or interruption, improving." Trinidad cocoa l.l.t. fetched 63*s.* to 64*s.* per cwt. on 9th March, while in New York on the same date 11½*c.* per lb. was realised for Trinidad and 11¾*c.* for Grenada Estates cocoa.

COFFEE.—All types of coffee have risen in price though the situation is complicated by the fact that, on the average, better qualities have been tendered. On 10th February prices included 160*s.* per cwt. for Costa Rica Middling, 140*s.* for Kenya Good Middling, and 100*s.* for Santos. During the following week a decline of about 5*s.* per cwt. was experienced in both Costa Ricas and Kenyas, but this was to some extent due to the lower average qualities tendered.

TEA.—Tea sales in London for January, 1925, amounted to 180,000 packages of Indian, 77,000 of Ceylon and 21,000 of Dutch East Indian. In January, 1926, the corresponding figures were 218,000, 94,000 and 12,000 packages. In spite of this great increase, prices, except for Ceylon, have risen, though at present, although all types sell freely, they appear only to be holding their own. Averages on 3rd February were, Ceylon 22.20*d.*, Indian 21.41*d.* and Java 17.23*d.* each per lb. East African tea is improving in popularity and quality.

RUBBER.—As previously announced in our February issue the exportable quota has now reached 100 per cent. of standard production. Opinions differ among experts as to whether this figure can be reached but we are inclined to believe that comparatively few estates can or will attain this level. Prices have continued to decline heavily. On 9th December, 1925, rubber realised 4*s.* 7*d.* per lb. while on 18th February the price had fallen to 2*s.* 5¼*d.* for both first crêpe and ribbed smoked sheet spot. Cuts in tyre prices of 10 per cent. have been announced by American tyre manufacturers. Stocks of rubber in dealers' hands in America are known to be very low, while manufacturers possess no compensating stocks, and since a hand-to-mouth policy has been pursued consumption is expected to be very heavy. The trend of prices is problematical but heavy fluctuations may be anticipated. Cabled reports record Plantation Sheet at 2*s.* 4*d.* per lb. on 9th March.

COPRA.—A good trade is reported in copra though only at reduced prices. F.A.Q. Ceylon to London sold at £29 15*s.* Sun-dried Straits to Rotterdam at £28 10*s.* and Straits to Marseilles at £27 15*s.* on 17th February showing falls of £1 15*s.*, £1, 5*s.*, and £2 respectively since the beginning of the year.

GROUND-NUTS.—A record trade was done during 1925.

ADVERTISEMENTS.

MR. HENRY H. R. MOLE, of Little Neck, Long Island, New York, has been appointed advertising agent for *Tropical Agriculture* in the United States of America and Canada. All communications from those countries respecting advertisements should be addressed to him. The address of our advertising agent in the United Kingdom is 14, Trinity Square, London, E.C.3. Firms in the West Indies and British Guiana are requested to address their communications to the Editor, *Tropical Agriculture*, Imperial College of Tropical Agriculture, Trinidad.